TECHNOLOGY DEPARTMENT

February, 1950

THE FOUNDRY

wherever metals are cast...

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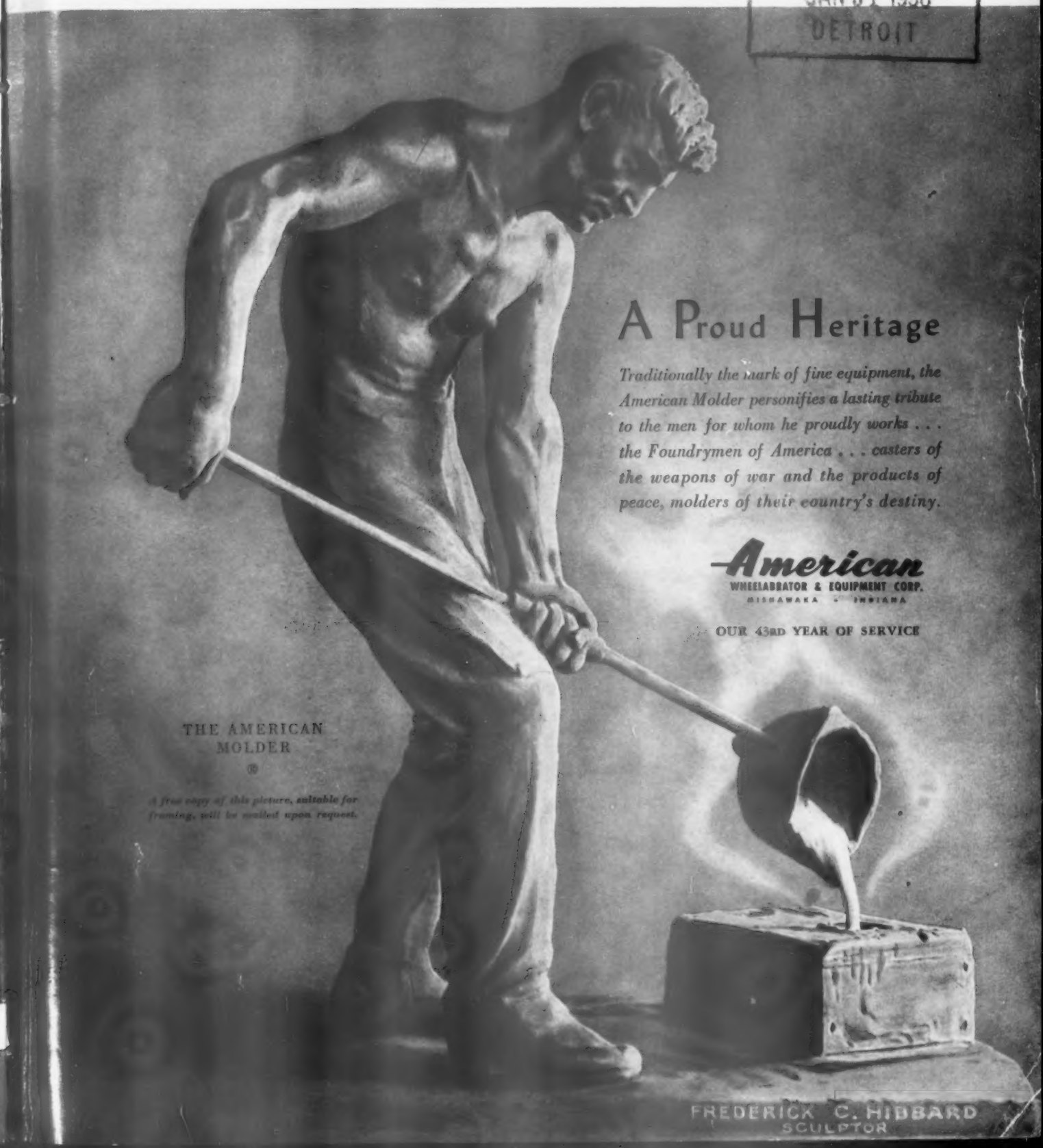


A Proud Heritage

Traditionally the mark of fine equipment, the American Molder personifies a lasting tribute to the men for whom he proudly works . . . the Foundrymen of America . . . casters of the weapons of war and the products of peace, molders of their country's destiny.

American
WHEELABRATOR & EQUIPMENT CORP.
MISHAWAKA · INDIANA

OUR 43RD YEAR OF SERVICE

THE AMERICAN MOLDER
®

A free copy of this picture, suitable for framing, will be mailed upon request.

FREDERICK C. HIBBARD
SCULPTOR

*Purite

FOUNDRY-PROVED ADVANTAGES GUARANTEE

Better Castings

When foundry after leading foundry changes to Purite and then continues to use it, you know there must be good practical reasons for the success of this economical desulphurizer and cupola flux. There are! Just note these outstanding advantages:

1. **Purite gives 100% fluxing action in the cupola — 100% desulphurizing action in the ladle.**
2. **Purite gets to the iron quicker — no faster desulphurizer made.**
3. **Purite is time-tested and proven for unsurpassed desulphurizing uniformity.**
4. **Purite comes in 2-lb. pigs — no weighing or measuring required.**
5. **Purite is 100% fused soda ash—you do not pay for inert materials.**
6. **Purite does not crumble—no waste—no dust.**
7. **Purite can be shipped in bulk carloads at substantial savings over bag shipments—is easily stored without deterioration.**

These day-to-day benefits explain why leading foundries throughout the country regard Purite as the foremost cupola flux and ladle desulphurizing agent. Write today for specific information on how Purite can improve your iron. Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

*PURITE

100% FUSED SODA ASH

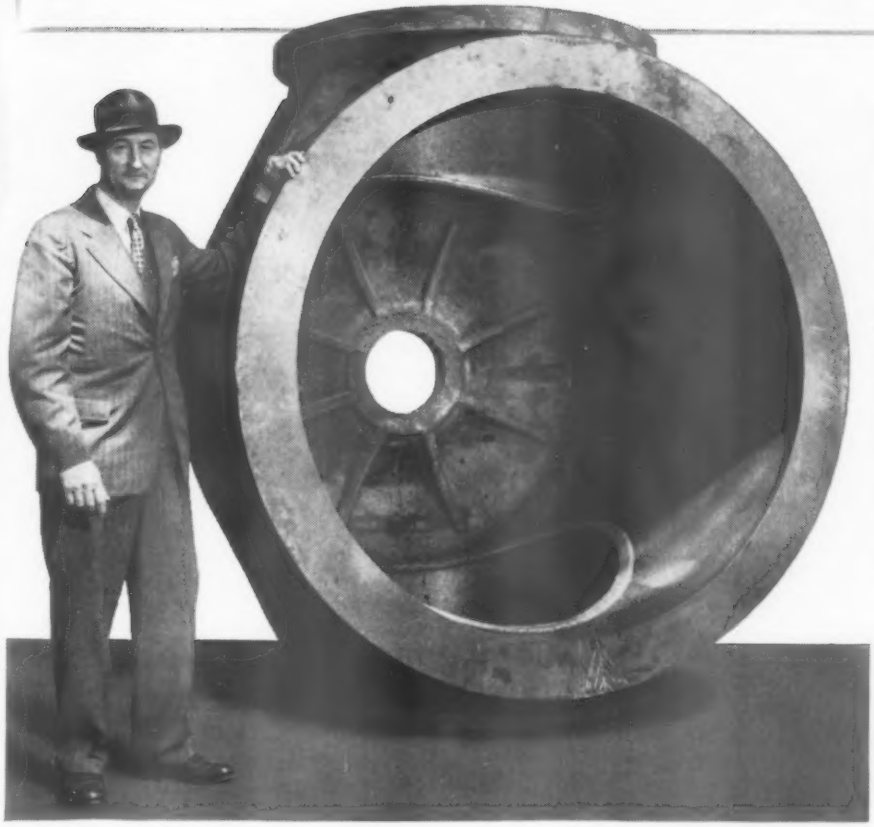
The Scientific Flux for Better Melting and Cleaner Iron

Mathieson CHEMICALS

7910

Purite is sold by all leading foundry supply houses in the United States and Canada.

Chapman Valves meet ASTM "Class 50" specifications *with Nickel Alloy Cast Iron*



50,000 PSI MINIMUM TENSILE STRENGTH DEVELOPED IN VALVE CASTINGS WEIGHING UP TO FIFTEEN TONS EACH

Containing 2.00 per cent nickel, 0.25 per cent molybdenum and 0.75 per cent chromium . . . these vital units cast by The Chapman Valve Manufacturing Company of Indian Orchard, Mass., comprise key parts of the equipment being supplied for the Delaware Aqueduct by S. Morgan Smith Company, York, Pa.

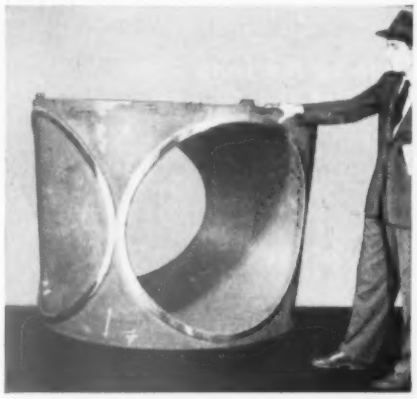
THE flow of a great underground river of Catskill mountain water for New York City will be controlled in subsurface valve chambers by these Chapman cone valves made of nickel alloy cast iron.

The nickel alloy iron adopted for these castings meets A.S.T.M. "Class 50" specifications, and provides sound, dense, high-strength units. Aqueduct valves, however, operate partially closed for long periods, and the resultant turbulence attacks surface metal of both seats and rings. To defeat this corrosive and erosive action, the Board of Water Supply specifies that these parts be faced with Monel*. The valve manufacturer applies Monel over a base layer of Ni-Rod*, the nickel electrode specially developed for cast iron welding.

Readily developing 50,000 p.s.i. tensile strength minimum, these valves exemplify how the right nickel cast iron not only helps foundrymen meet high mechanical property specifications, but the metal also assures trouble-free performance for the ultimate user.

Write for our recommendations regarding the best nickel alloyed iron for your applications.

*Reg. U. S. Pat. Off.



This cone for the 42" Chapman nickel iron valve body, pictured above, shows the Monel facing applied over a Ni-Rod base to provide maximum resistance to erosion and corrosion.

EMBLEM OF INCO SERVICE

Over the years, International Nickel has accumulated a fund of useful information on the properties, treatment, fabrication and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes, nickel silver, cupro-nickel and other alloys containing nickel. This information is yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 WALL STREET
NEW YORK 5, N. Y.

A *Helping Hand*

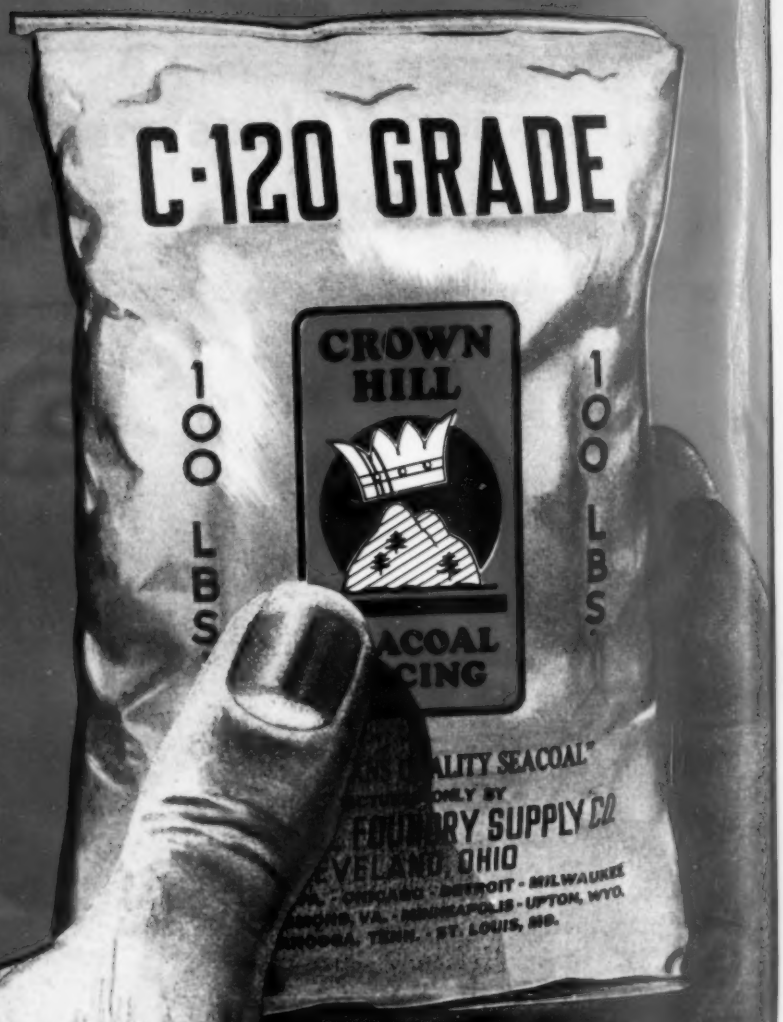
for Foundrymen Everywhere

● Foundrymen everywhere choose Crown Hill Seacoal Facing. Here's why: Crown Hill cuts cleaning costs, produces a smoother finish and eliminates hard spots.

Made from high volatile, quick-flash coal, Crown Hill vents rapidly. Low sulphur content eliminates hard spots. Because of the high fusion point of its small ash content, molten iron cannot fuse to it.

Put Crown Hill Seacoal Facing to the test in your own foundry (like so many others have) and see the difference.

Made by the Long-Time Friend of the Foundries



FIGURES FROM BUREAU OF MINES
DEPT. OF INTERIOR OF THE U. S.
(Moisture Free)

PROXIMATE ANALYSIS	
Volatile Matter (V.C.M.)	38.9%
Fixed Carbon	57.4%
Ash	3.7%
	100.0%

ULTIMATE ANALYSIS	
Hydrogen	5.4%
Carbon	82.0%
Nitrogen	1.6%
Oxygen	6.8%
Sulphur	.7%
Ash	3.7%
	100.0%
Fusion Point of Ash	2,980° F.

- *It vents the mold quickly*
- *Eliminates hard spots*
- *Cuts cleaning costs*

THE FEDERAL FOUNDRY SUPPLY COMPANY

Seacoal Plant
CROWN HILL, W. VA. • CHICAGO • DETROIT • MILWAUKEE • RICHMOND, VA.
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FEBRUARY, 1950

THE FOUNDRY

VOLUME 78—NUMBER 2

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Published by

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NEW EQUIPMENT DIGEST

Subscription: In the United States and possessions, Canada, Mexico, Cuba, Central and South America, one year $3; two years $5. Other foreign countries, $6. Single copies 35 cents. Copies published three months or more previous to date of current issue, 50 cents.

Member: Audit Bureau of Circulations and National Publishers Association. Copyright 1950 by THE PENTON PUBLISHING CO

Entered as second class matter at postoffice at Cleveland under act of March 3, 1879.

THE FOUNDRY is indexed regularly by Engineering Index Inc.
29 West 39th St., New York 18

Editorial 69

Casting the Large Statue of Washington 70
By PAT DWYER

The Cupola—Its Raw Materials and Operation 76
By B. P. MULCAHY

Handling Materials in Metal Pouring 78
By ROBERT H. HERRMANN

Cupola Dust Collection 84
By WILLIAM N. WITHERIDGE

Tractor Foundry Employs Efficient Scheduling Methods 86
By FRANK W. SHIPLEY

Fracture Test for Melt Quality of Bronze Castings 94
By JAMES O'KEEFFE JR. and HOWARD F. TAYLOR

Solidification of Molten Metal 97
By NORMAN F. HINDLE

Flasks and Rigging for Steel Castings (Part II) 98
By JOHN HOWE HALL

AFS Nominees and Tentative Convention Program 114

Electric Furnace Steel Committee Conference 117
By EDWIN BREMER

Determination of Selenium in Stainless Steel 121
By N. S. MOTT

Back Injury Prevention 124
By WILLIAM R. BLEWETT

Foundry Education Foundation Campaign 127

Casting Centrifugally in Graphite Molds 132
By JOHN PUTCHINSKI

Casting Alloys for Permanent Magnets 146
By THOMAS A. DICKINSON

Man-to-Man on the Molder's Bench 154
By RALPH L. LEE

Crane Drum Molded and Poured on End 158
By PAT DWYER

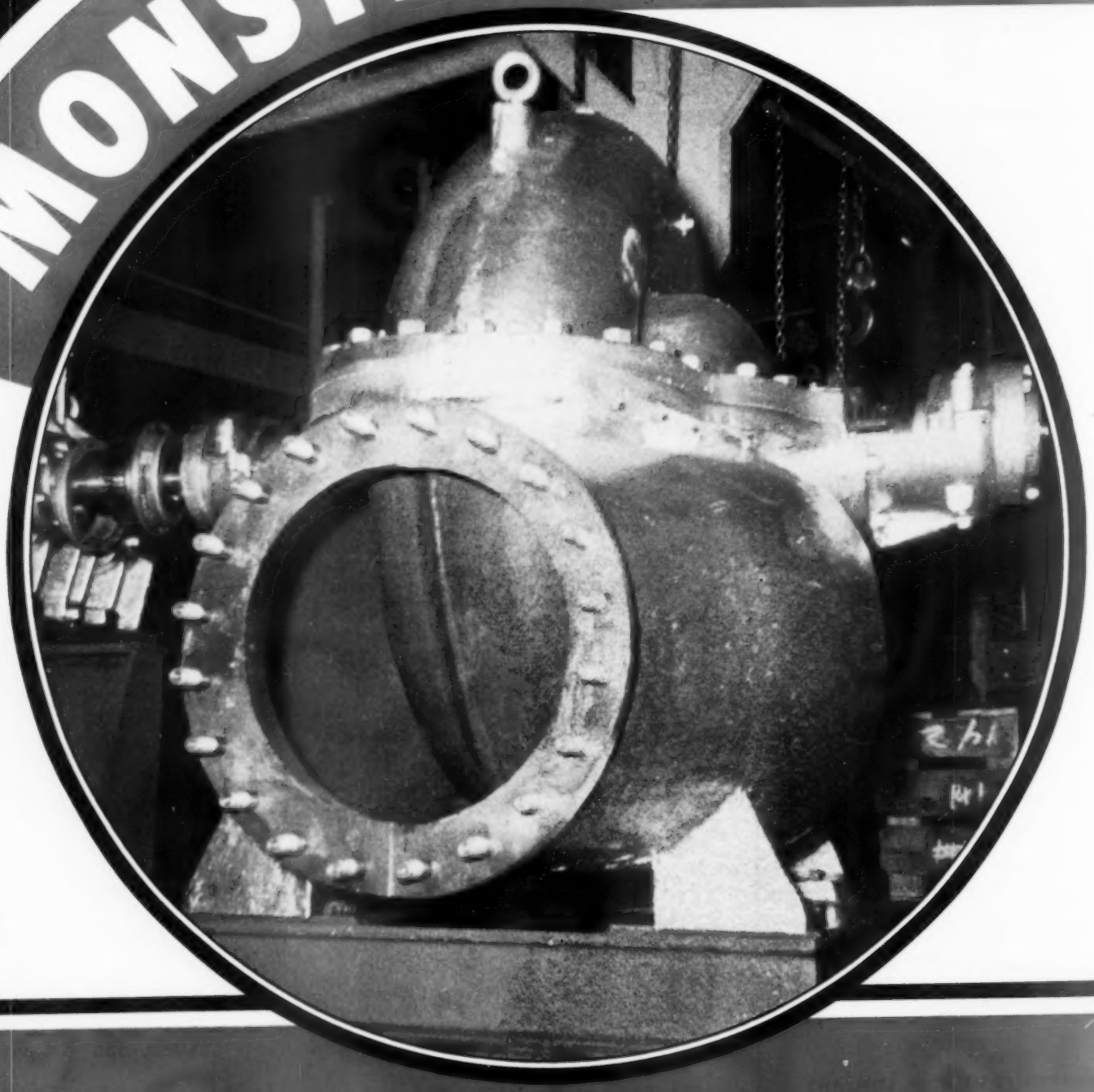
The Adventures of Bill 160
By PAT DWYER

Rapid Determination of Nickel in Brass and Bronze 170
By C. GOLDBERG

Around Detroit 172
By ARTHUR H. ALLEN

Questions and Answers 100
Men of Industry 106
Industry Briefs 122
Obituary 128
Foundry Developments 130
Meeting Calendar 138
Readers' Comment 141
Foundry Statistics 156
Activities of Foundry Groups 176
Foundry Data Sheet 195
Equipment and Supplies 212
Helpful Literature 215
Trade Publications 239
Where-to-Buy Directory 258
Advertisers' Index 277

MONSTER PUMP—



THIS MONSTER HANDLES 8,500 GALLONS PER MINUTE!

A 20" Double Suction Pump cast by Hetherington and Berner, Inc., to specifications of the Dean Hill Pump Company. Steam Turbine Drive through a 7 to 1 reduction gear . . . pumps out 8,500 gallons per minute. LINOIL cored it!

CORED AND CAST IN LINOIL CORE MOLDS!

at

HETHERINGTON and BERNER, INC. INDIANAPOLIS, INDIANA

Typical of the large size jobbing work produced by Hetherington and Berner is this 20" Double Suction Pump—cored and cast in a dry sand mold. Here, LINOIL core molds saved the cost of a special-built flask for an unusual-size, small-order job. These huge, thick cores baked out evenly—right through to their centers—to assure a successful casting.

ONE OIL CORES MOST ALL JOBS "We make many kinds of castings with one or two oil-sand mixes, and we can always depend upon LINOIL to do the job properly", says Superintendent Louis Meyers. Fewer mixes simplify production . . . saving considerable time and labor.

NO LOSSES FROM CORE OIL VARIATIONS. Rigid laboratory control assures foundrymen of uniform, "fool-proof" performance from each drum of LINOIL . . . maintaining economy . . . and safeguarding production.

CORE MOLD for ONE-HALF of the Pump

A portion of the center core shows in the background. Upper right—Steam Jacketed Elbows—another Hetherington and Berner specialty—cored and cast in LINOIL core molds.

Cope half of pump center core

THE LINOIL — THE LOGICAL OIL

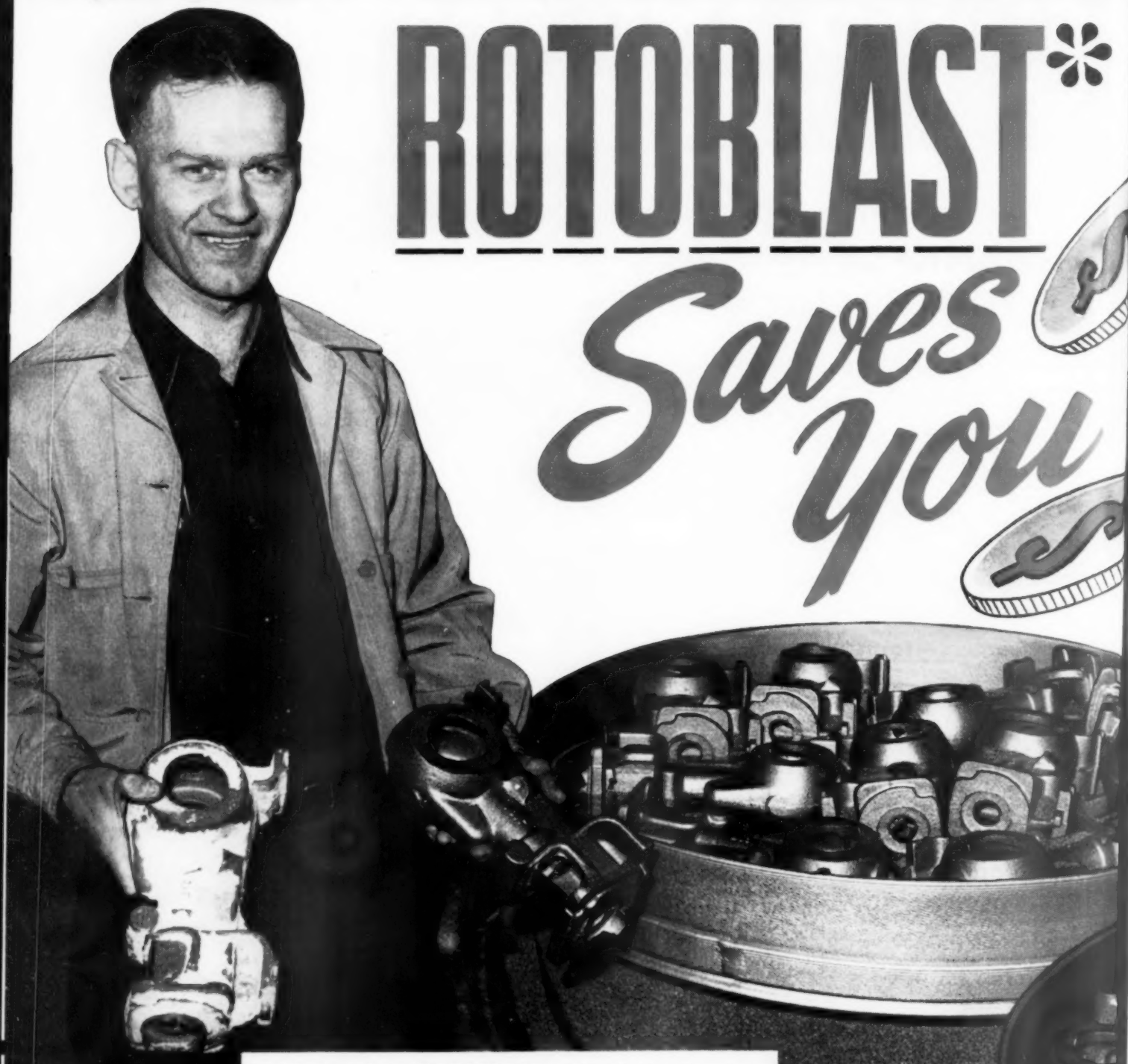
THE WERNER G. SMITH COMPANY

(DIVISION OF ARCHER-DANIELS-MIDLAND COMPANY)

2191 WEST 110th STREET • CLEVELAND 2, OHIO

ROTOBLAST*

Saves you $

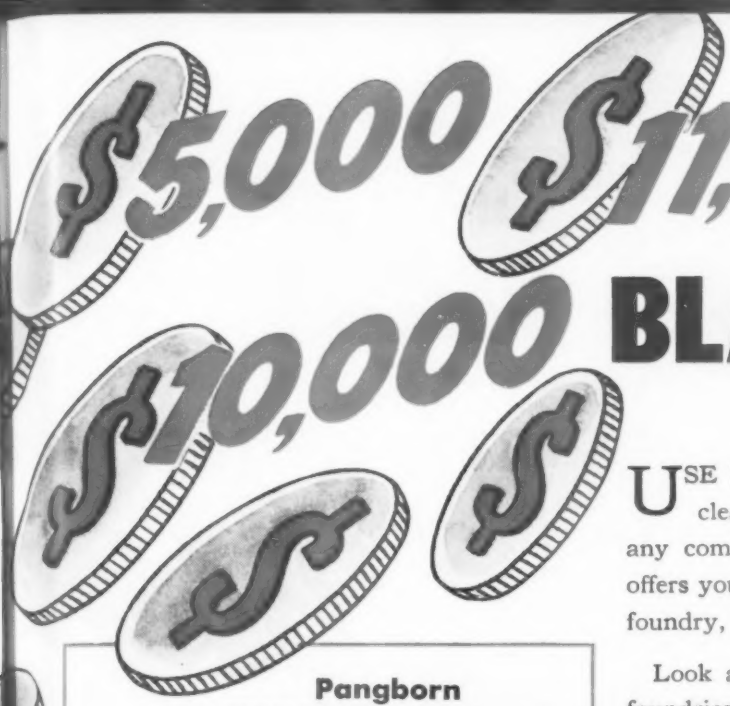


All Pangborn ROTOBLAST units—Tables, Barrels, Rooms, Table-Rooms or Continuous-Flo Barrels—are designed to clean your work faster and better, and at the same time *save you money*. See the chart at the right for actual savings as reported by satisfied ROTOBLAST users.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Pangborn

* Trademark of Pangborn Corporation



on BLAST CLEANING!

USE ROTOBLAST and you save money! No matter what you clean: large or small castings, fragile or intricate castings, or any combination—your best bet is ROTOBLAST! Only Pangborn offers you a money-saving ROTOBLAST unit to fit the needs of any foundry, large, medium or small.

Look at the amount of cash ROTOBLAST has saved for actual foundries as reported below. *In every case* ROTOBLAST cut cleaning time, saved labor and maintenance and reduced operating expenses to the tune of thousands of dollars a year.

Pangborn ROTOBLAST saves you money these *five* ways:

SAVES LABOR: *One ROTOBLAST machine and operator can do as much as a two-man crew and old-fashioned equipment.*

SAVES SPACE: *In many cases, one ROTOBLAST machine replaces five or more old-fashioned machines, requires less space.*

SAVES TIME: *Cases on record prove ROTOBLAST can cut cleaning time up to 95.8% compared with old-style methods.*

SAVES POWER: *Modern ROTOBLAST uses but 15-20 h.p. compared to old-fashioned equipment requiring 120 h.p. for same job.*

SAVES TOOLS: *On work cleaned with ROTOBLAST, cutting tools last up to 2/3 longer because no scale is left to dull edges.*

SAVINGS MEAN PROFITS

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

USERS REPORT IMPRESSIVE SAVINGS WITH ROTOBLAST

ROTOBLAST UNIT	CASH SAVED	NAME OF USER
Table-Room	$5,452 *on labor and maintenance*	Champion Blower & Forge Co., Lancaster, Pennsylvania
Table-Room	$11,102 *on labor alone*	Lewistown Foundry, Lewistown, Pennsylvania
Room	$10,160 *on labor alone*	Harris-Seybold, Cleveland, Ohio
Barrel	$5,080 *on labor alone*	Yates-American Machine Co., Beloit, Wisconsin

Yes—ROTOBLAST offers the ideal solution to *your blast cleaning problems*. Cleaning efficiency is equally high, whether you operate at 50% or full capacity. To get *faster blast cleaning* in your plant—specify Pangborn ROTOBLAST!

GET THE FACTS! Find out how much money *you* can save with ROTOBLAST. Bulletin 214 contains technical details. Or send us your problem and we'll show you how ROTOBLAST can solve it. But write today . . . just address PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md.

MORE THAN 25,000 PANGBORN MACHINES SERVING INDUSTRY

BLAST CLEANS CHEAPER

with the right equipment for every job

"Control Over Quality And Costs Paramount"

THE FOUNDRY—WHEREVER METALS ARE CAST

—MAKES IT WORTH WHILE TO

"Champion"

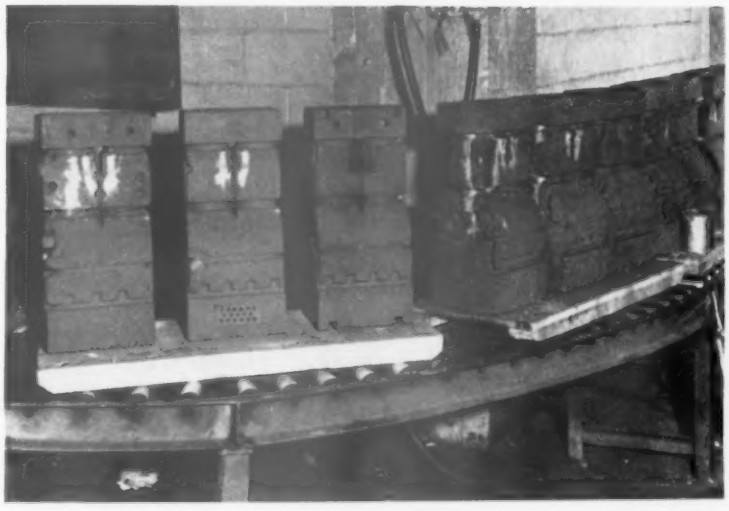
YOUR FOUNDRY

You take a long step forward toward quality and cost control when you equip with Champion Core Blowers and Molding Machines. Foundrymen of long experience designed and built these machines on the basis of a sound knowledge of what it takes to produce high quality castings at a profit. That's why you'll find Champion equipment at work in the leading foundries such as those represented in this advertisement.

Champion CB12 Core Blower, at National Sewing Machine Company, Belvidere, Illinois, blows cores for this late model portable electric sewing machine. "They do a first class job, FAST."

Champion CB18 Core Blower at Oliver Farm Equipment Company's foundry at Charles City, Iowa. Six similar sections blown on this machine form the core of a six cylinder gasoline engine casting, used in the power plant of the latest type farm tractor.

"ize"



From the newest, smallest model, the "Junior" Champion, up to the mammoth CB400, every Champion Core Blower possesses the same distinctive features, the same unique blow valve, which assure a perfect core every time, in a fraction of a second, with the standard air pressure of 85 pounds.

Operation is safe, simple, speedy! There's a size and type for every job. Talk with us about your core requirements . . . you'll find it pays!

CHAMPION FOUNDRY AND MACHINE COMPANY

SALES OFFICE: 1314 W. 21st STREET, CHICAGO 8, ILLINOIS

GENERAL OFFICE AND PLANT: ROCKFORD, ILLINOIS

MOLDING MACHINES · CORE BLOWERS · THE ELECTRIC RIDDLE

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Mauricio Hochschild & Cia. Ltd.
Casilla 153 D, Santiago, Chile

Societa Torinese Adesivi Resine
Corso Moncalieri 414, Torina, Italy

NEW . . . IMPROVED PARTING

DELTA PARTEX
NUT SHELL PARTING

FOR

Faster Production

OF FINER-FINISH CASTINGS

DELTA PARTEX is a superfine, waterproofed powder made from selected nut shells. It contains no harmful or hazardous ingredients. It is safe, easy and economical to use. It flows like water, dusts freely through the shaker bag and covers all surfaces uniformly.

DELTA PARTEX has the properties and characteristics of lycopodium at only a fraction of the cost.

DELTA PARTEX works faster, saves time and lasts longer. Core boxes and patterns stay cleaner with fewer applications.

DELTA PARTEX has a uniform surface affinity for sand. It will not pile up in corners. It is non-reactive with molten metal and will not pit nor etch metal patterns or core boxes. It will not contaminate or change the characteristics of core and molding sands.

Ask for a liberal working sample for test purposes and prove to yourself the advantages of DELTA PARTEX in your foundry.

9 IMPORTANT REASONS WHY DELTA PARTEX IS MORE EFFICIENT AND MORE ECONOMICAL TO USE . . .

1. No silicosis hazard.
2. Has the properties and characteristics of lycopodium.
3. Is non-reactive with molten metal.
4. Will not pit nor etch metal patterns and core boxes.
5. Will not contaminate nor reduce fusion point of core and molding sands.

6. Has uniform surface affinity for sand.
7. Leaves casting surfaces clean and free from contamination for plating work.
8. Is free-dusting through shaker bag.
9. Is moisture-resisting and will not deteriorate on aging.

DELTA OIL PRODUCTS CO.
MILWAUKEE 9, WISCONSIN

NOW...

CARBON ANALYSIS

in a FLASH

...ELECTRONICALLY WITH NEW STANDARDS OF ACCURACY

- Ready in the morning in 57 seconds. Instantly from then on.
- 90% less power consumption.
- No limit on temperatures.
- Glass combustion tube provides visibility of operation.
- Combustion tubes at half the cost, last many times longer.
- Shorter tube advantageous for volumetric method.
- No elements to burn out.
- Heats nothing but the sample.
- Eliminates excess heat from laboratory.

For further details ask for Bulletin 910.

VOLUMETRIC
GRAVIMETRIC

	for...
Carbon	Steel
Sulphur	Cast Iron
	Alloys
	Stainless

LINDBERG LABORATORY DIVISION

Lindberg Engineering Company • 2453 West Hubbard Street • Chicago 12, Illinois

Having ROOF trouble?

Use TASIL to prolong roof life of direct arc furnaces

• When operating conditions are just too rugged for ordinary refractories, Taylor Sillimanite (TASIL) is being installed and increasing roof life on Direct Arc Furnaces at lower refractory cost per ton. TASIL can do the same for you.

Roofs formed of TASIL ramming mix, bricks and special shapes are in service today on furnaces ranging in size from 50 pounds to giant 50 ton units, melting a great variety of steels and alloys. TASIL specified for:

High Softening Point
P. C. E. of Cone 38 (3335° F.) or 200 to 300° F. above those of the best grades of silica, super-duty silica, fire clay and super-duty fire brick.

High Hot Strength
No gradual softening below the critical point.

High Spalling Resistance
No loss in Standard ASTM Panel Spalling Test.

Chemical Stability
Attacked by high iron slags, but more slowly than fire clay base, silica or other high alumina refractories.

The initial cost of TASIL is slightly higher, but when that all-important denominator—REFRACTORY COST PER TON OR PER HEAT—is calculated, TASIL costs LESS.

Contact the Taylor representative in your area or write us direct to get the facts on the savings possible in YOUR plant.

Refractorers to industry since 1864.

Exclusive Agents in Canada:
REFRACTORIES ENGINEERING AND SUPPLIES, LTD.
Hamilton and Montreal

The CHAS. TAYLOR SONS Co.
REG. U. S. PAT. OFF.
MANUFACTURERS OF REFRACTORIES • CINCINNATI • OHIO • U. S. A.

Jolt-squeezer molding stations in a large gray iron foundry.

WHAT JEFFREY MAKES FOR THE FOUNDRY:

PADDLE MIXERS
SCREENS
SANDITIONERS
MOLD CONVEYORS
AERATORS
BIN VALVES
CONVEYORS
BUCKET ELEVATORS
FLASK FILLERS

Jeffrey-Equipped means Efficient Operation

This photo shows the pouring and mold transfer in the same foundry – molding stations in background.

THE JEFFREY MANUFACTURING COMPANY

907 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 1	Buffalo 2	Cleveland 13	Harlan	Jacksonville	Pittsburgh 22
Birmingham 3	Chicago 1	Denver 2	Houston 5	Milwaukee	St. Louis 3
Boston 16	Cincinnati 2	Detroit 13	Huntington 19	New York 7	Salt Lake City 1
				Philadelphia 3	Scranton 3

BETTER CASTINGS...DIRECT SAVINGS

quickly pay for

COLEMAN core and mold OVENS

● **REDUCE YOUR OPERATING COSTS** by replacing obsolete, inefficient core and mold ovens with Coleman Ovens. Why waste money using worn-out ovens? Install Coleman Ovens which quickly pay for themselves through immediate direct savings—savings which start in the core room and molding department and end up with perfect castings! It will pay you to investigate Coleman Ovens today because of these vitally important cost-saving advantages:

DEPENDABLE BAKING AND DRYING. All guesswork in core baking and mold drying removed. Rejects and make-overs eliminated.

INCREASED LABOR SAVING. Efficient and modern mechanical designs reduce handling and other indirect labor to a minimum.

HEAVY DUTY CONSTRUCTION. Responsible for dependable performance, economical operation, and minimum maintenance cost.

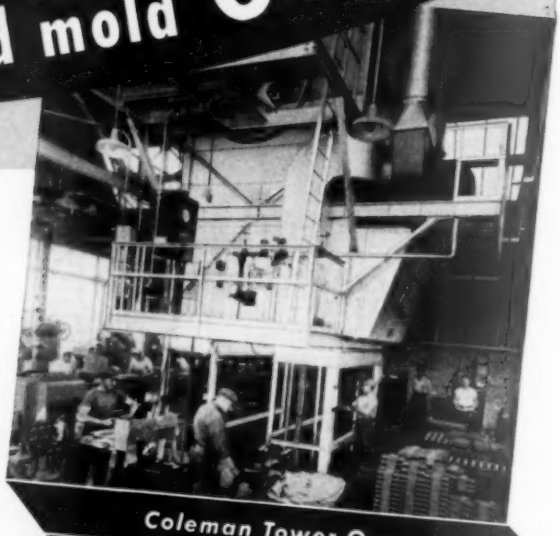
MAXIMUM FUEL ECONOMY. Coleman Heating Systems use the most economical fuel available to you—gas, oil, stoker-coal, electricity, etc.

BETTER WORKING CONDITIONS. Positive ventilation built into Coleman Ovens prevents leakage of fumes and gases—helps to make the core department a better place to work.

COMPLETE RANGE OF TYPES AND SIZES to meet every need.

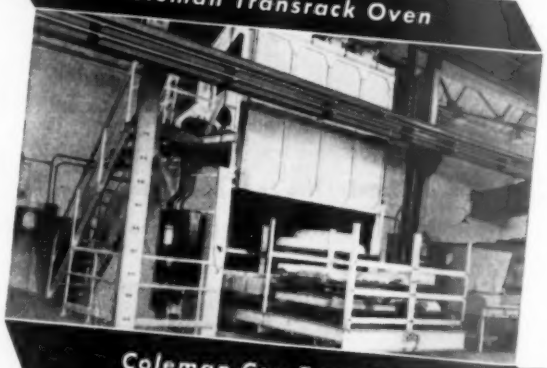
ADVANCED OVEN KNOW-HOW. Coleman Engineers have pioneered and developed the most efficient foundry oven designs. We will gladly study your operating conditions and recommend the type of Coleman Oven that will do your work at the lowest cost for fuel and labor.

Write today for Bulletin 48



Coleman Tower Oven

Coleman Transrack Oven



Coleman Car-Type Oven

Coleman Rolling Drawer Oven

THE FOUNDRY EQUIPMENT COMPANY

1831 COLUMBUS ROAD CLEVELAND 13, OHIO

World's Oldest and Largest Foundry Oven Specialists

OVER 10,000 SUCCESSFUL INSTALLATIONS

SHORTER and SNAPPIER!

New Rotor "Multi-power" Chipper gets into crowded quarters ...gets the job done faster

The "doughnut" valve of the 15 new Rotor "Multi-power" Chipping Hammers makes possible greater compactness of design and gives faster cutting. It is a real "cost-sinker".

Shorter and lighter. The 15 new "Multi-power" Rotor Chippers average 1″ to 2″ shorter than other chippers—easier to get into corners. It weighs 1½ to 2 lbs. less than other hammers—easier to handle.

3 Tools in 1. The unique design makes it easy to adapt each hammer for 3 types of service by a simple change of parts. You have: (1) A "regular" model, (2) A "super-speed" model, (3) A "super-sock" model—to match your job.

Faster. New exclusive design of valve and hollow piston gets jobs done faster.

Write for complete details today! Ask for catalogue No. 37.

AIR O'TOOL

WHAT CAN A FOUNDRYMAN DO?

POOR QUALITY COKE

WHEN COKE goes from bad to worse, more coke is required. Spout metal temperatures are down, with cupolas delivering less than rated capacity . . . refractories burn out faster, replacements are more expensive.

With costs up, quality down, and rejects eating away at profits . . . no wonder foundry operators are tearing their hair. Yet customers are demanding higher quality castings.

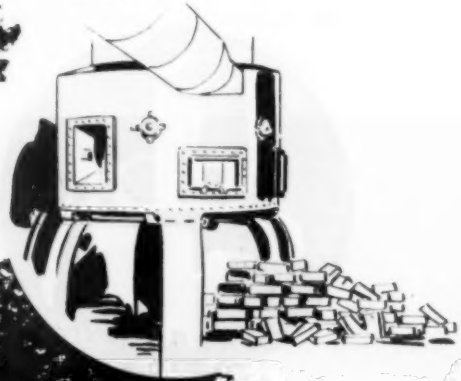
WE OFFER NO PANACEA

LOW POURING TEMPERATURES

Whiting has been in the foundry business too long to suggest a cure-all . . . but foundrymen who have changed to Whiting Cone-Bottom Charging Buckets are amazed at how much their foundry practice is improved.

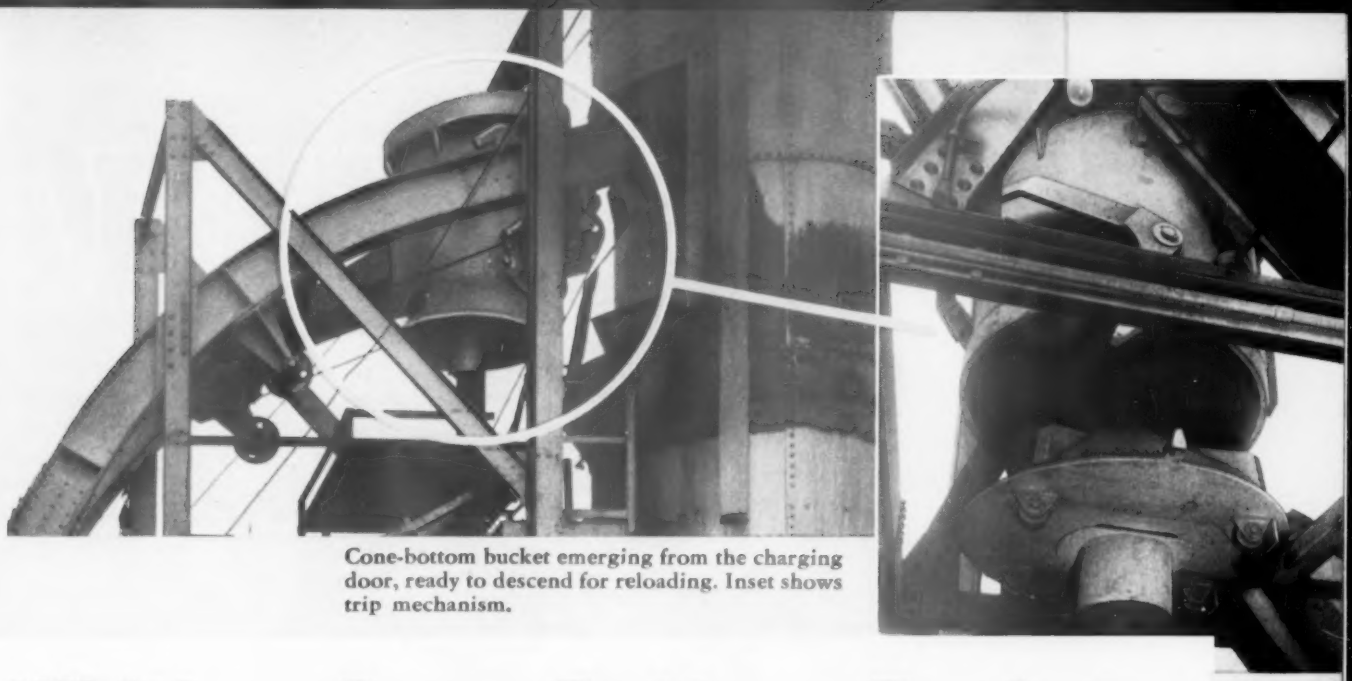
One operator recently told us, "Since installing your cone-bottom bucket, we are getting the hottest iron we've had since 1937." Then he proceeded to order another Whiting Bucket to replace one that came with his other (non-Whiting) charger.

If you are having trouble, don't wait! Call for a Whiting sales engineer, today.



REFRACTORY BURNOUTS

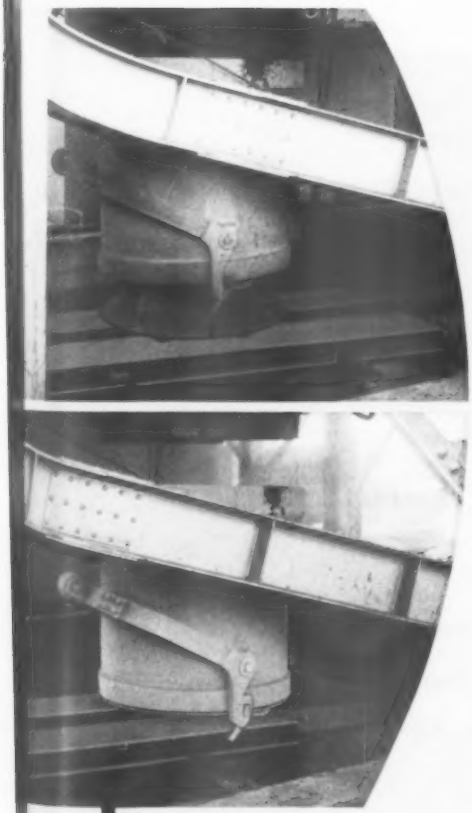
TOO MANY REJECTS



Cone-bottom bucket emerging from the charging door, ready to descend for reloading. Inset shows trip mechanism.

Whiting Cone-Bottom Buckets

FOR A MECHANICAL CHARGING JOB THAT CAN NOT BE EQUALLED EVEN BY THE BEST HAND-CHARGING PRACTICE



Two views show operation of the automatic bucket-closing mechanism. Above, the bucket is open—cone about to come down against the plates which raise it against the latch. In lower illustration, the bucket has closed and latched.

Whiting Cone-Bottom Buckets distribute the charge evenly around the outer edge and leave it more open in the center. Hence the blast distribution and gas flow are more uniform—bringing higher metal temperatures with less coke and less oxidation, and faster melting.

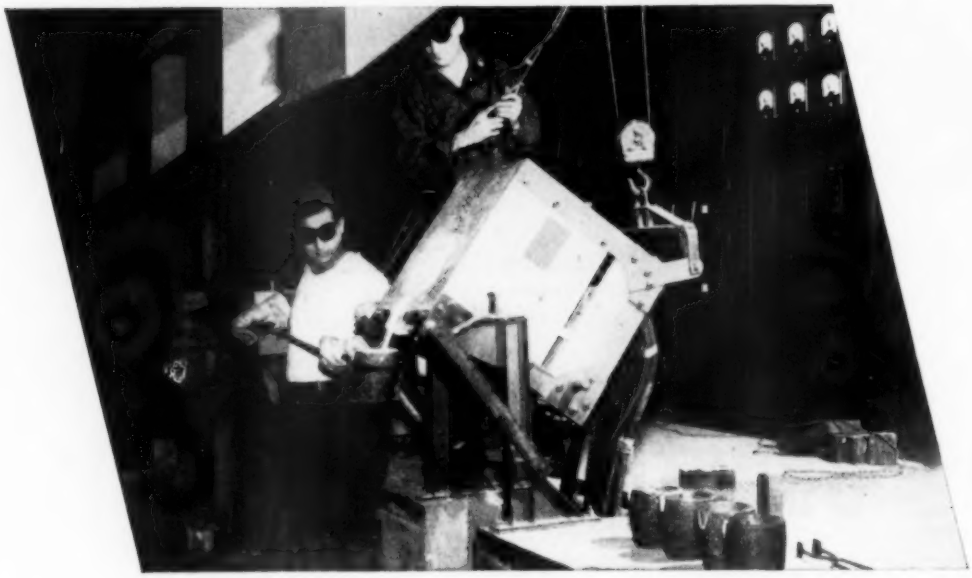
You can secure these benefits of cone-bottom charging from your present equipment by replacing drop-bottom buckets with Whiting Cone-Bottom Buckets. The new Buckets require no "wishbone" within the cupola; they are discharged by a release lever which opens automatically when the bucket arrives in discharge position in the cupola, and closes automatically as the bucket returns for loading. Full information on request.

WHITING
CORPORATION

15607 Lathrop Ave. Harvey, Illinois

Offices in Chicago, Cincinnati, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Agents in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church St., New York 7, N.Y.

RM 1169: Symbol of Success



RM 1169 is the mixture number of Norton Company's MAG-NORITE cement which has proved so successful for lining high frequency induction furnaces for high melting non-ferrous alloys.

RM 1169 cement is a coarse grained mixture consisting of electrically fused magnesia grains plus enough ceramic binder to insure dense packing when it is rammed dry into the furnace.

RM 1169 MAGNORITE cement is chemically suitable for melting high temperature non-ferrous alloys. It has the physical properties for a lining of strength and long life. RM 1169 matures at 1150° C. (2100° F.). Its maximum use temperature is 1800° C. (3250° F.).

There is a Norton Refractory Cement for every non-ferrous melting operation. A Norton Refractories Engineer will be glad to specify the correct cements for your furnaces. You may obtain a free booklet describing Norton Refractory cements and their applications by writing for catalog No. 863.

NORTON COMPANY
Worcester 6, Massachusetts

APEX

Z-50

ALLOY

Your production line is your profit line—safeguard it by using APEX Z-50, a proven quality alloy. Having uniform casting characteristics with better-than-average mechanical properties, *and free machinability,* APEX Z-50 will meet most of your casting requirements. When quality plus economy is paramount, specify APEX Z-50—"Proved Best By Test"!

Apex Smelting Company

Chicago • Cleveland

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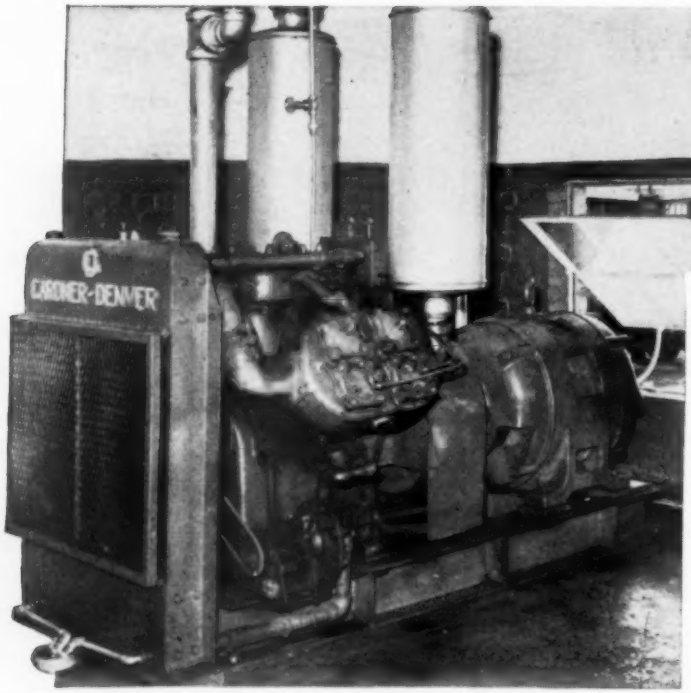
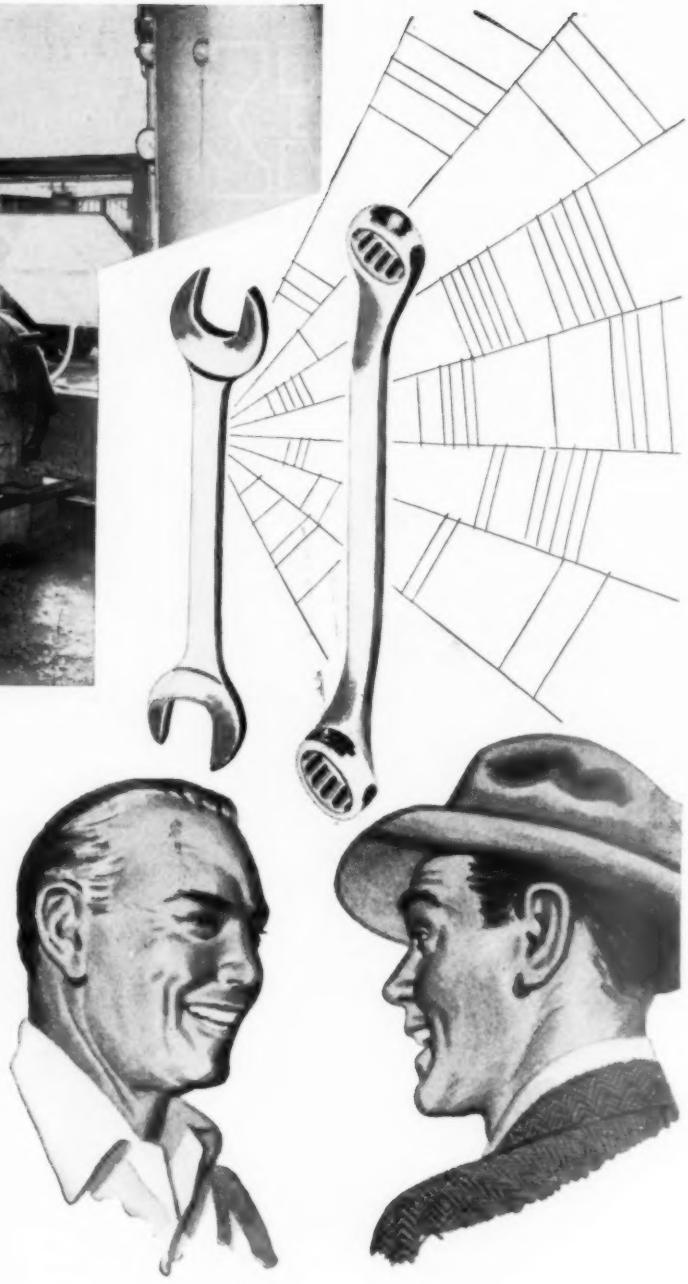




"6,552 WORKING HOURS— AND WE HAVEN'T TOUCHED IT YET!"

"Our WB Compressor has now been in operation for a total of 6,552 working hours. A wrench has never touched the machine, and not one single cent has been spent for repairs. We plan to have the valves cleaned soon, but outside of that, the machine is in perfect running order."

—excerpt from owner's letter.

Low maintenance is just *one* of many major advantages in a Gardner-Denver WB Vertical, Two-Stage, Water-Cooled Compressor. You get big capacity, high efficiency air supply in limited space. A self-contained cooling system effectively lowers the discharge temperature—permits operation where good cooling water is scarce. And the WB is a packaged unit, easily installed and ready to go to work.

Gardner-Denver WB Compressors are built in capacities from 142 to 686 cubic feet displacement per minute. Write today for full details.

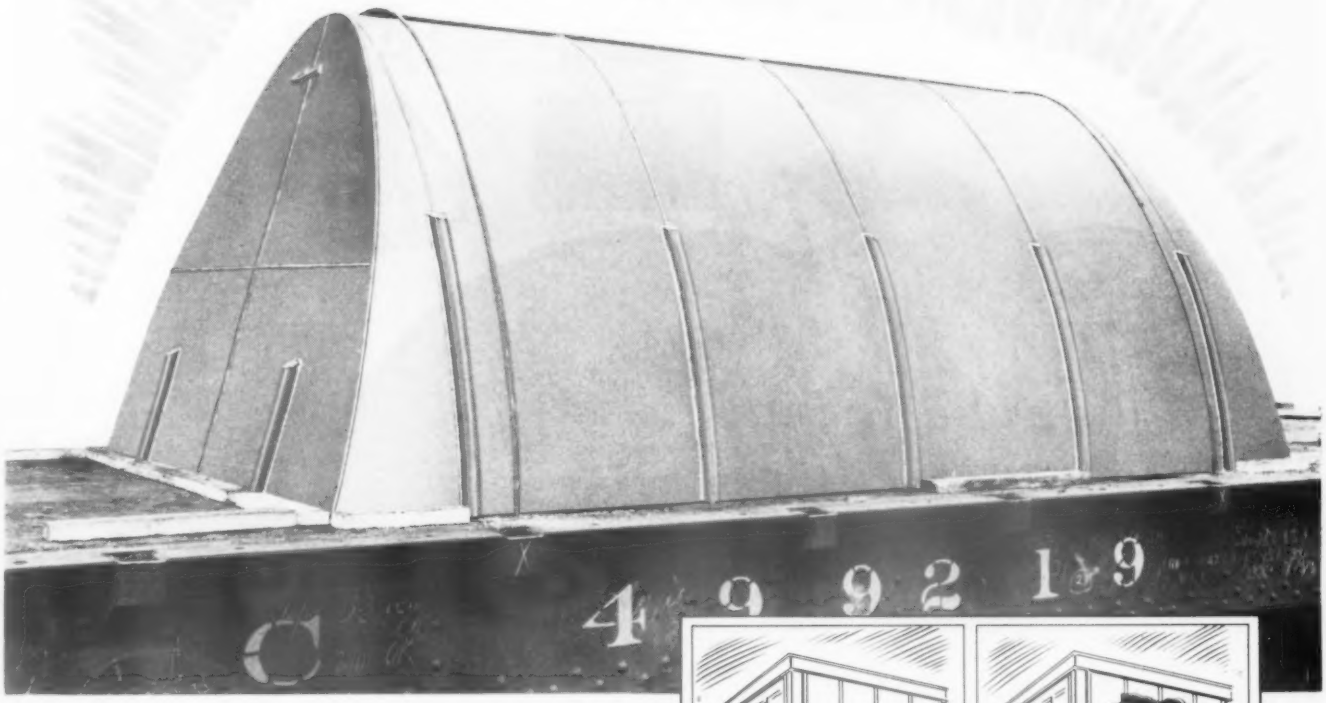
SINCE 1859

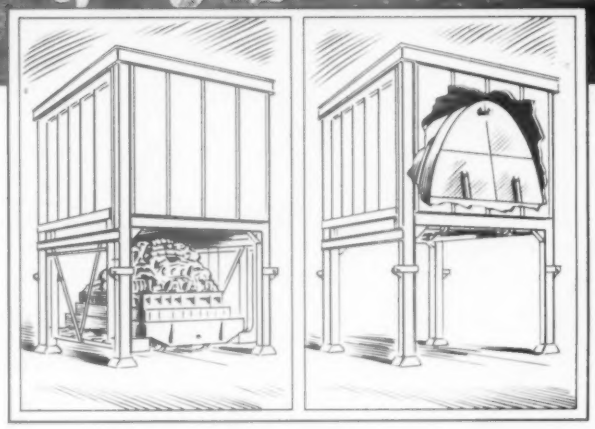
GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada:
Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

Now PSC ANNEALING COVERS *for* ELEVATOR FURNACES





Top: view of a PSC annealing cover for elevator furnace service, ready for shipment. Of chrome-nickel alloy; 6 ft. high by 8 ft. by 14 ft.; used in a coal-fired malleablizing furnace. Below: sketch of furnace and cut-away view of cover installed.

New or Replacement Installations for All Furnaces

If you use or build elevator-type furnaces we invite you to take advantage of our twenty years experience in fabricating annealing covers. We make available to you a wealth of designing and production know-how, gained from supplying the majority of the nation's steel mills and many leading foundries with covers for their floor-type furnaces. Whether you are installing new furnaces or need replacement covers let us send you information how PSC welded alloy annealing covers shorten heating cycles and cut fuel costs.

Light-Weight Annealing Containers and Covers for Every Purpose

We will furnish covers, to your blue prints, for any size or make of elevator furnace, and in any alloy to meet your firing requirements. PSC manufactures a complete line of annealing and carburizing boxes, covers, baskets, racks, tubes, retorts, etc. Let us furnish you details as to how PSC light gauge welded alloy equipment shortens heating and handling time, saves fuel, and increases furnace capacity. Send blue prints or write as to your needs.

THE PRESSED STEEL COMPANY
of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

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Use FANNER CHAPLETS and CHILLS

IMPORTANT!

Two motion picture films —one on the use of Chaplets, the other on the use of Chills—are available, free of charge, for showing at Foreman Club meetings, in technical schools, A. F. A. chapter meetings, etc. Write for reservation.

for BETTER CASTINGS

Birdseye view of the Fanner Brookside Park Plant in Cleveland

. . . . because Fanner Chaplets and Chills embody more than half a century of sound basic chaplet and chill designing for specific needs . . . only metallurgically correct materials . . . . an exceptional record of performance in reducing scrap losses . . . . an economy of purchase because the Fanner line includes many as "standards" priced elsewhere as "specials".

Our Engineering Department is at your service, and welcomes your problems. Write — no obligation, of course.

THE FANNER MFG. CO., CLEVELAND 1, OHIO

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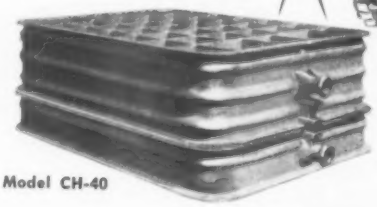
TRUSCON
MARK OF MERIT PRODUCTS

TRUSCON STEEL FOUNDRY FLASKS

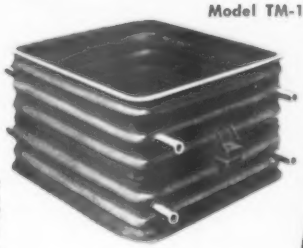
just say "*Truscon*"...

Model OM-1



Model CH-40

Model TM-10



Truscon manufactures one-man, two-man and power handled flasks available to meet your own particular production requirements.

A battery of Truscon Steel Flasks in use in a large mid-west foundry.

and there's the *flask* you need!

Truscon has scores of different types of flasks to meet a wide range of foundry requirements. And if your needs are something special, Truscon has the engineering ability to tailor-make the exact units you require. Truscon's long experience in flask design . . . Truscon's highly efficient facilities for flask production and service . . . Truscon's long association with flask users in every branch of the foundry industry . . . these are *plus* features that make your dollar investment in Truscon Steel Foundry Flasks so much more profitable. Write for catalog showing wide range of Truscon Steel Flasks available, and ask for an experienced Truscon foundry man to help plan your needs efficiently.

TRUSCON STEEL COMPANY

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SUBSIDIARY OF REPUBLIC STEEL CORPORATION

TIME OUT FOR FRESH AIR

—Mounts into money!

Schneible Multi-Wash System Keeps them on the job!

Sure—we've exaggerated—but we both know that poor foundry ventilation offers an excuse for the worker to leave the job—when one leaves usually others follow. This procedure, multiplied for a year may cost you a Schneible Multi-wash system, labor turnover and loss of profits.

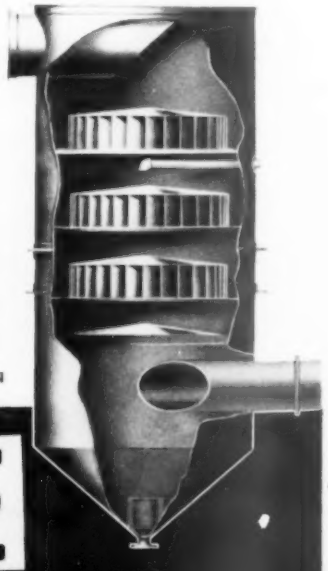
The Schneible Multi-wash system in combination with one or more of our many types of Uni-flo hoods can clean up any foundry ventilation problem—in high speed production line foundries or jobbing shops turning out large custom castings.

We suggest a spot check throughout your foundry for a production leak through poor ventilation. Then, plug it by calling in Schneible engineers and getting the facts about the Multi-wash system that exactly fits your particular needs. Schneible Engineers are located in principal cities.

MULTI-Wash COLLECTORS

Model HC—1500 to 30,000 c.f.m. or multiple units for larger capacities.

Model JC—1000 to 30,000 c.f.m. or in multiple units, if greater capacity desired.



CLAUDE B. SCHNEIBLE COMPANY

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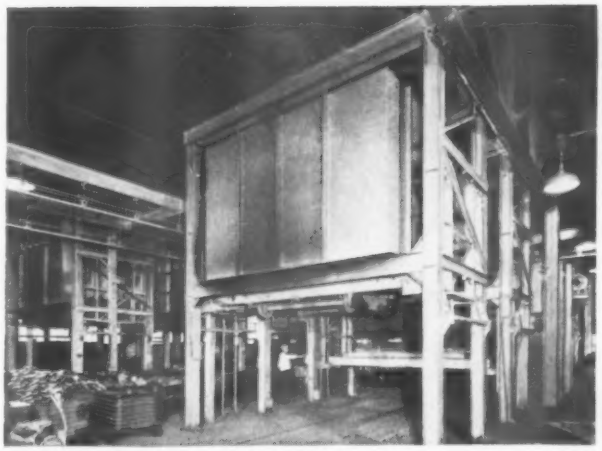
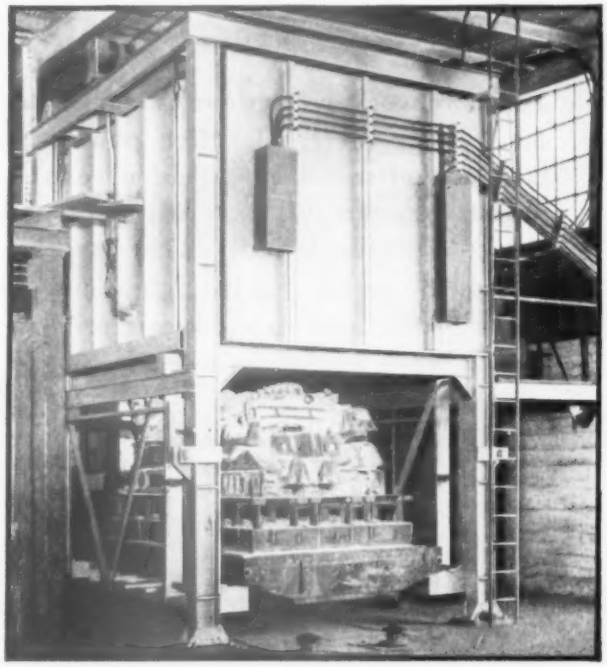
U. S. and Foreign Patents Pending

SCHNEIBLE



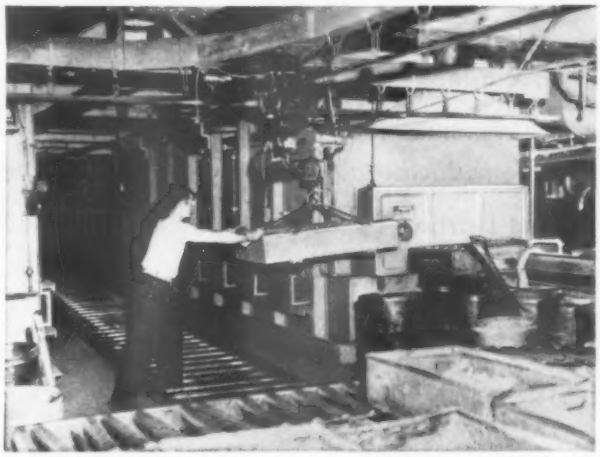
. . . four pairs of G-E electric furnaces anneal 32 tons per day in this midwestern foundry.

Annealing malleable iron castings



. . . one G-E elevator furnace anneals 10 tons per charge in this southern foundry.

Annealing steel castings



. . . two pusher-type G-E furnaces anneal 30 tons per day in this eastern plant.

Annealing grey iron castings

DO IT BETTER *Electrically*

Tell us about your annealing job, and we'll show you what General Electric furnaces can do for your particular operation. G-E furnaces and electronic induction heaters are also available in a variety of types and ratings for brazing, hardening, drawing, soldering, carburizing, and most other heat-treating processes. Ask your nearest G-E office to put you in touch with a G-E Industrial Heating Specialist. Or write direct to *Sect. 720-9, Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

ELECTRIC FURNACES

In addition to a shorter time cycle and increased output, they also give you:

- **Lower over-all cost**
- **More uniform, better quality anneal**
- **Materially reduced cleaning costs**
- **Minimized thermal losses**
- **Cleaner, cooler working conditions**
- **Dependable continuity of service with less maintenance**
- **Less floor space required**

GENERAL ELECTRIC

720-9

Remove excess metal faster with CLECO Grinders and Sanders

For more work in less time, CLECO Grinders and Sanders are preferred. High power, perfect balance and smoother operation result in lowest costs through increased speed and reduced operator fatigue. The other CLECO features listed at the right result in long life and reduced maintenance. Write for full information.

- **Plenty of power and speed.**
- **Continuous lubrication of entire motor assembly.**
- **Balanced design for smooth operation and reduced operator fatigue.**
- **Governor controls motor speed at all loads — reducing air consumption.**
- **Instant starting and steady power.**

COMPLETE RANGE OF SIZES

CLECO Grinders and Sanders are made in all sizes — for fine tool and die work or heavy duty production grinding. Write for full information.

CLECO MAKES AIR TOOLS FOR EVERY PURPOSE

Grinders — Sanders — Rotary Drills
Riveters — Sand Rammers — Chippers
Scaling Tools — Impact Wrenches — Screwdrivers — Hose Fittings — Sump Pumps

Air power is safe, clean, flexible and highly productive. For air-powered tools built to highest quality standards, insist on CLECO air tools, bearing this familiar trade mark

CLECO

Back of CLECO Products . . . with 25 years experience in precision manufacturing, is the REED ROLLER BIT COMPANY, one of the largest companies of its kind in the world.

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CLECO DIVISION

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DISTRIBUTORS IN PRINCIPAL CITIES OF THE UNITED STATES AND THROUGHOUT THE WORLD

You Get RELIABLE LOW-COST PERFORMANCE and UNUSUALLY LONG SERVICE LIFE from

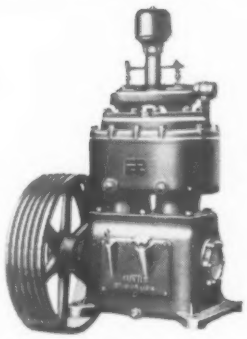
Curtis

AIR

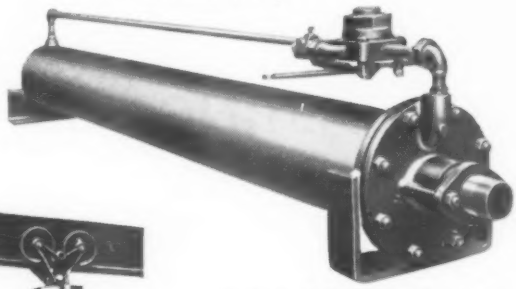
Hoists

Cylinders

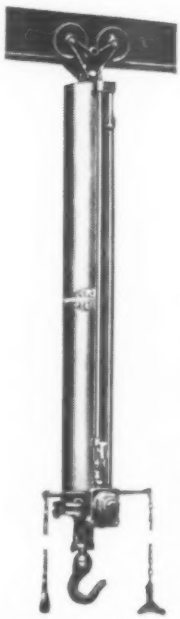
Compressors



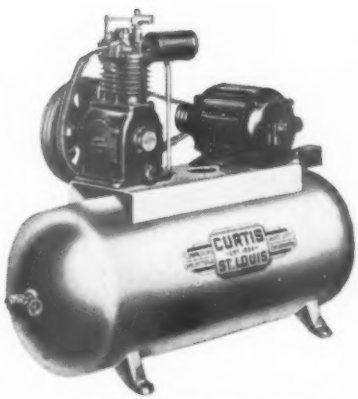
Model C Water-Cooled Compressors, up to 50 H.P. Fully Enclosed — Dust and Dirt Proof — Carbon-free Valves. Timken Bearings.



Curtis Air Cylinders For Almost Any Pushing, Pulling or Hoisting Operation.



Curtis Air Hoists Provide Accurate, Low-Cost Lifting of Material or Machines.



Curtis Model F Air Compressors are available as either electric or gasoline motor-driven units (electric motor-driven portable or stationary). Up to 10 H.P.

Industrial plants throughout the country are using Curtis Compressors, Hoists, and Cylinders to reduce production cost through man hours saved.

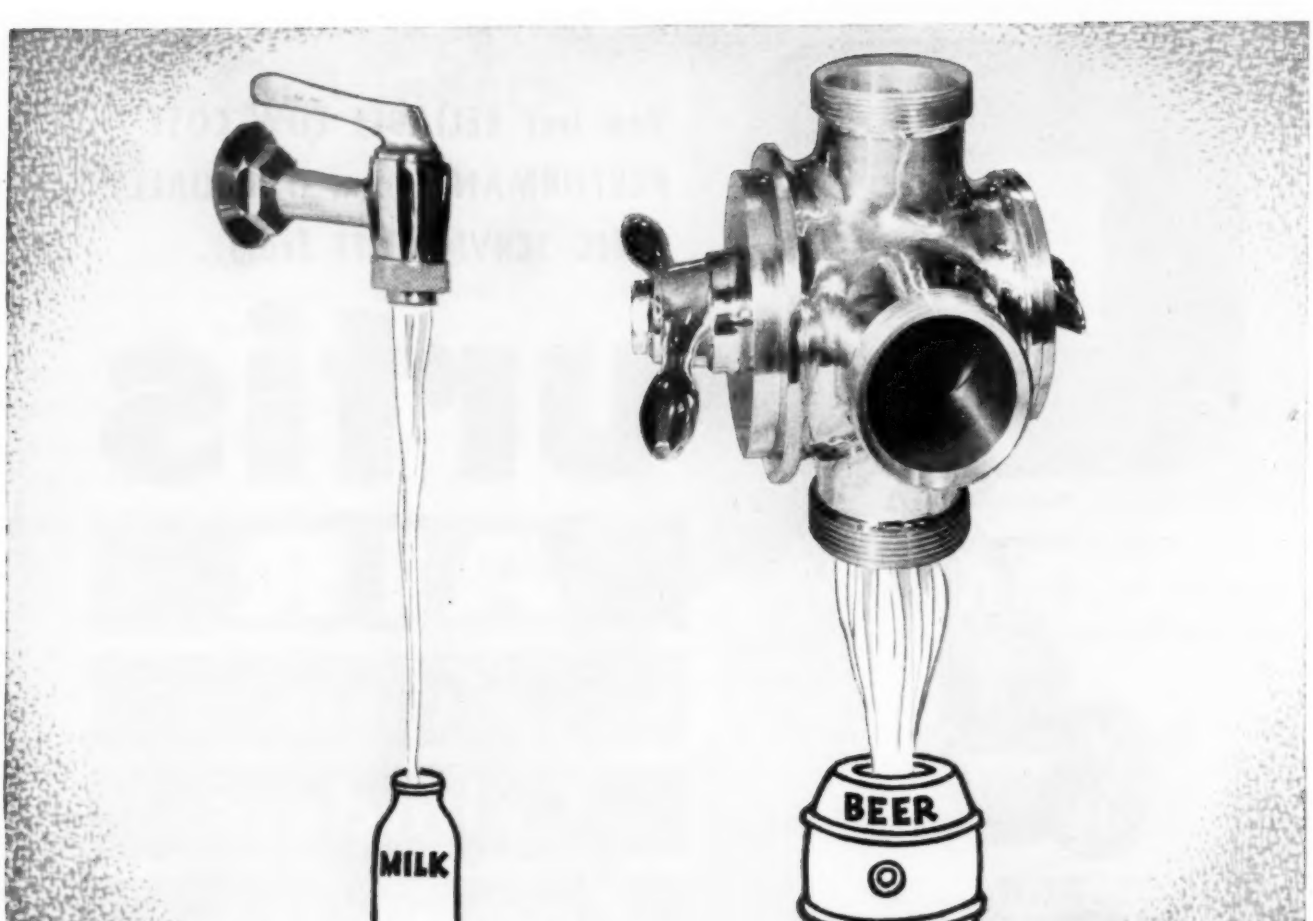
Curtis equipment is precision built by a company with 96 Years of Successful Manufacturing Experience—Your assurance of proper performance from the moment Curtis equipment is installed.

CURTIS PNEUMATIC MACHINERY DIVISION I 50-1
of Curtis Manufacturing Company
1922 Kienlen Avenue, St. Louis 20, Mo.

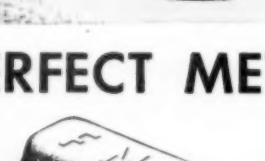
I am interested in items checked below:

☐ Air Hoists
☐ Air Cylinders
☐ Air Compressors

Name.....
Firm.....
Street.....
City.....Zone....State.....



PERFECT METAL–PERFECT CASTINGS!



The small valve is for the dairy industry; the large one for the brewery field. Both are cast of Federated Nickel Silver . . . for very good reason.

Since 1912 the Specialty Brass Company, Kenosha, Wisconsin, has been making castings for dairy equipment. Then, and even more so now, the demands of this food industry forbid the use of castings with even the slightest blemish. Brewery equipment must likewise be virtually perfect.

To produce such castings consistently . . . and to be famous for it . . . Specialty Brass uses the best in methods, and the *best in materials*. Specialty uses Federated Nickel Silver exclusively.

Nickel silver alloys are particularly suited for use where high corrosion resistance and silvery white color are important. Federated metallurgists can tell you exactly what alloy fits your need. They are ready and willing to help out in your foundry, too, should casting problems arise.

For nickel silvers; brasses and bronzes; aluminum and magnesium alloys; solders; babbitts; fabricated lead products; for any non-ferrous metals, see Federated first.

Federated first in the non-ferrous field FMD

Federated METALS DIVISION

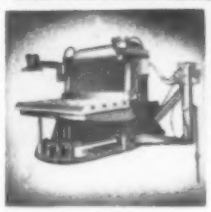
AMERICAN SMELTING AND REFINING COMPANY, 120 BROADWAY, NEW YORK 5, N. Y.

Oh Boy

DID YOU SEE that "Davenport Molding Machine?"

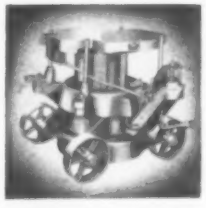
It sure saves time—and makes better, more uniform castings. Davenport Molding Machines are easy to install—simple to operate—sturdy in construction—positive in action—with low maintenance cost.

Let us send you our complete catalog showing over 60 sizes and styles.

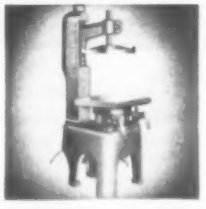


Jolt Rollover Draw, Model A

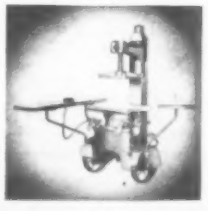
Jolt Rollover Draw, Model SA



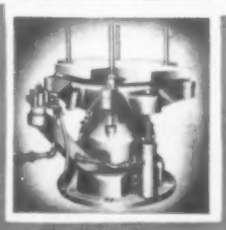
Jolt Pin Lift, Model AJS (portable)



Jolt Squeeze, Model 10-JX (stationary)



Jolt Squeeze, Model 10-JX (portable)



Jolt Pin Lift Model AJS (stationary)

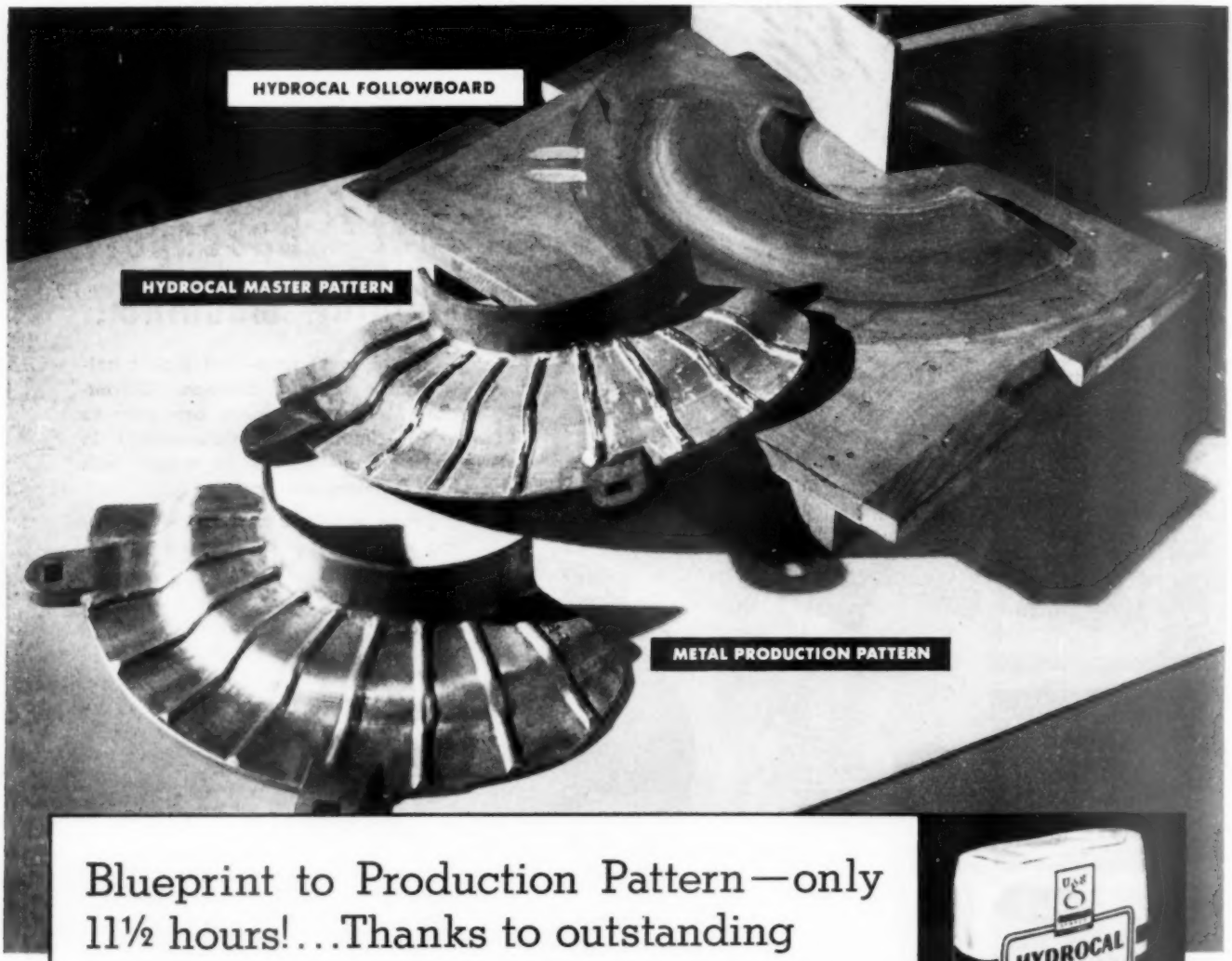
DAVENPORT MACHINE AND Foundry Company

DAVENPORT IOWA U. S. A.

CANADA:
Canadian Foundry Supplies & Equip. Ltd.
Toronto and Montreal

FRANCE · BELGIUM · NETHERLANDS · LUXEMBURG · SWITZERLAND
Ph. Bonvillain & E. Ronceray, Choisy-Le-Roi
Rue Paul Carle, Seine, France

ALL OTHER FOREIGN COUNTRIES
R. K. Price Associates, Inc.
70 Pine St., New York 5, New York, U.S.A.



Blueprint to Production Pattern—only 11½ hours!...Thanks to outstanding

ADAPTABILITY

The HYDROCAL* master pattern and the aluminum production pattern were made at the Southern Precision Pattern Works, Birmingham, Alabama—important users of HYDROCAL Gypsum Cements.

HYDROCAL Gypsum Cement was chosen for this job because its ready adaptability to complex and irregular shapes meant savings in time and money. Both the HYDROCAL master and the aluminum production pattern were made in less time than is usually required for a single master pattern made by conventional methods.

*HYDROCAL and HYDROSTONE are trademarks reg. U. S. Pat. Off. for super-strength gypsum cements manufactured by U. S. Gypsum Co.

TYPES OF HYDROCAL FOR PATTERN SHOPS

Pattern Shop HYDROCAL, general purpose gypsum cement.

HYDROCAL B-11, for built up or template formed models or patterns.

*HYDROSTONE**, hardest and strongest gypsum cement for duplicate patterns. Must be cast. Cannot be worked under template.

High Expansion HYDROCAL, to expand dimensions of a pattern to compensate for metal shrinkage.

United States Gypsum

For Building • For Industry

Gypsum • Lime • Steel • Insulation • Roofing • Paint

In Canada, CANADIAN GYPSUM COMPANY, Limited
170 Bloor St., West, Toronto, Ontario

mail this coupon NOW for latest bulletins

UNITED STATES GYPSUM COMPANY
Dept. F-2-50, Chicago 6, Illinois

Gentlemen:

Please send me copies of your latest bulletins as checked below.

- ☐ IGL-103, How to Make Pattern Stock with HYDROCAL Gypsum Cement.
- ☐ IGL-104, How to Check a Core Box with HYDROCAL Gypsum Cement.
- ☐ IGL-105, How to Make a HYDROCAL Gypsum Cement Follow Board.
- ☐ IGL-106, HYDROCAL Gypsum Cement Combined with Blended Shapes.
- ☐ IGL-107, How to Make a Core Box with HYDROCAL Gypsum Cement.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

This Foundry is a Good Place to Work

American Steel Foundries, Newark Works.

AMERICAN Steel Foundries, with plants throughout the country, is the world's largest producer of steel castings. Its Newark facilities are of the most advanced type, including high-frequency induction melting furnaces, high temperature heat treating furnaces, quenching tanks, pickling equipment, etc., for producing corrosion and heat resisting castings.

It is a good place to work for other reasons: All operations are under complete technical and laboratory control by a staff of experts; Magnetic and Radiograph inspection methods; aggressive good housekeeping practice; quality production based on 40 years of progressive thinking.

Herman Molding Machines contribute to this Company's efforts to make its foundry a good place to work. Herman jolt rollover machines, with a single rotary control operating valve, are simple to operate. A timer controls all jarring. Pattern draw equalizer adjusts itself to all irregularities in flask or bottom board.

Herman Machines are working every day everywhere, because they've made their way by the way they're made. May we hear from you?

Herman MOLDING MACHINES

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH, PA.

Simple Solution to Moisture Content Problems in Cupola Air Blast

UNIQUE DEW POINT CONTROL

Here's another important and timely advance in foundry instrumentation . . . dew point control for cupola air blast. This recent Foxboro development is available for either measuring and recording or measuring and controlling dew point. The recorder provides a record of humidity conditions so fast and faithfully that you can offset any variations, before they start trouble, by altering the coke-air input. The controller will hold humidity to a uniform high moisture by simple regulation of moisture addition to the blast, or will control dehumidifying equipment to maintain constant low moisture conditions.

The humidity sensitive element of Foxboro Dew Point Control is *the Dewcel* Bulb—uniquely different! Used with Foxboro Recording or Controlling Instruments, it has several distinct advantages over other systems of measuring dew point.

1. **Records directly in dew point with easy conversion to absolute humidity**
2. **Has wide range of working temperatures**
3. **Neither adds nor removes water from atmosphere**
4. **Sustained high accuracy of measurement**
5. **Requires no water box or refrigeration**

Foxboro Dew Point Instruments are simple and easy to install. The recording or controlling instrument may be located at any reasonable distance from blast line . . . on the charging floor or in the "super's" office.

As the next improvement in your foundry, investigate Dew Point Control. Send for (Dewcel) Bulletin 407. **The Foxboro Company, 32 Neponset Avenue, Foxboro, Mass., U. S. A.**

The Foxboro Dynalog Dew Point Temperature Recorder (top) utilizes the exclusive Dynalog electronic measuring system . . . unmatched for its combination of speed, accuracy and simplicity. Because it has no slidewire, its balancing action is completely STEPLESS as well as continuous. Illustration also shows power unit and unique Dewcel element.

This system gives direct recordings of dew point from —20°F. to +160°F. at working temperatures from —20°F. to +220°F.

FOXBORO
REG. U. S. PAT. OFF.

RECORDING · CONTROLLING · INDICATING
INSTRUMENTS

GREATER EFFICIENCY - MORE PROFIT

America is a nation where the sky is the limit. We reach for the stars of plenty, peace, and abundant living. Foundrymen take ideas from among the 'stars' and make them work. They bring ideas down to earth, cast them into enduring metal and send them out to serve all mankind. In this vital drama of production AMERICAN is proud of the important role it has played — and will continue to play — in engineering and building the best in cost cutting, profit-building equipment.

American DUSTUBE EFFICIENCY AND COST SAVINGS

PERFORMANCE PROVEN AT ANTHES-IMPERIAL CO., LTD.

Anthes-Imperial Co., Ltd. is the largest producer of soil pipe in the British Empire. In addition they produce a complete line of hot water, steam and warm air heating equipment.

The foundry in which the gray iron castings are produced contains modern and efficient facilities for quality high production. A Dustube Dust Collector is used for ventilating a large Wheelabrator Cabinet and a battery of grinders.

Mr. J. L. Fotes, *Foundry Superintendent*

"When I came to this foundry, I was very happy to discover that all cleaning and grinding operations were being ventilated with a Dustube Dust Collector. My experience with these units in other foundries has been exceptionally good in terms of efficiency and cost-saving performance. The simple, practical design of the Dustube provides the highest efficiency at the lowest possible cost."

Mr. W. J. Cameron, *Mechanical Superintendent*

"The Dustube Dust Collector has been a profitable investment from every standpoint. We benefit in a business way through employee good will and their freedom from worry of dusty conditions far beyond the small amount invested in the collector. The Dustube is a simple and compact unit providing dependable, economical performance."

Mr. Alfred Briard, *Maintenance Foreman*

"Our Dustube Dust Collector operates so quietly and efficiently that the only attention it has required is periodic inspections. These are fast and simple since all work is on the clean air side of the collector. Maintenance is at a minimum because the tubes are never under tension, and never in contact with abrading or corrosive metal."

American WHEELABRATOR & EQUIPMENT CORP.

505 S. Byrkit St., Mishawaka 2, Indiana

PLEASE TURN PAGE

ELKHART IRON WORKS cuts cleaning costs 66⅔%

Saves $5,440 YEARLY

COST COMPARISON CHART

	FORMER METHOD	WHEELABRATOR METHOD
MACHINE	3 tumbling mills	66" Wheelabrator Swing Table
PRODUCTION	2 tons per day	4 tons per day
LABOR	2 men — 12 man hours per day	2 men — 6 man hours per day
CLEANING COST	Per ton — $8.095	Per ton — $2.655

SAVINGS

per ton **$5.44**
per day **$21.76**
per year **$5,440.00**

The Elkhart Iron Works of Elkhart, Indiana, with a production of only four tons daily, has a wide variety of castings to clean because of the many building specialties they produce. Their previous cleaning method was unsatisfactory because of high breakage, and the relatively high cost of cleaning. They were also dissatisfied with the quality of the cleaning, and the necessity for blasting many of the larger pieces in an air blast room.

The 66" Wheelabrator Swing Table was the answer to their problem. It eliminated costly breakage, cut cleaning costs 66⅔%, did a thorough job of cleaning, and produced a finish much more satisfactory to their customers.

There is no sounder investment than a Wheelabrator because it customarily pays for itself out of savings within 6 to 18 months. An expert analysis of your cleaning problems by one of our engineers will show you definitely how this can be done. Why not take this action soon? Doing so may put thousands of dollars on the profit side of your business every year.

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

THE AMERICAN WHEELABRATOR

American

HEELABRATOR® Saves Saves Saves Saves

DO YOU WANT PROOF FROM A FOUNDRY LIKE YOUR OWN?

Pick any of the Case Histories below, and let us give you complete details

CASE HISTORY No. 1 **Layne & Bowler, Inc.** eliminated an airblast room and 2 tumbling mills with a 72" Wheelabrator Swing Table for cleaning gray iron and brass pump and water well castings.

SAVED **$ 5,290** YEARLY

CASE HISTORY No. 2 **Love Bros., Inc.** by installing a car-type Wheelabrator Room slashed cleaning time 50%, reduced chipping time by 35% and eliminated an airblast room for cleaning large gray iron castings.

SAVED **$ 7,310** YEARLY

CASE HISTORY No. 3 **West Michigan Steel Foundry Co.** replaced 3 airblast rooms with a 60" x 96" Wheelabrator Tumblast to handle 1300 tons of steel castings monthly.

SAVED **$ 17,898** YEARLY

CASE HISTORY No. 4 **A prominent Midwest foundry** eliminated 14 tumbling mills and an airblast room and 14 laborers for cleaning cylinder blocks with a Wheelabrator Monorail Cabinet.

SAVED **$ 27,540** YEARLY

CASE HISTORY No. 5 **Sawbrook Steel Castings Co.** replaced two airblast cabinets with a 72" Wheelabrator Twin Table for cleaning steel castings weighing up to 3500 lbs.

SAVED **$ 10,275** YEARLY

CASE HISTORY No. 6 **Geneva Metal Wheel Co.** replaced 3 tumbling mills and an airblast room with a 66" Wheelabrator Swing Table for removing sand from spoked and solid cast wheels.

SAVED **$ 4,275** YEARLY

CASE HISTORY No. 7 **Ohio Cultivator Div.** installed a 36" x 42" Wheelabrator Tumblast for cleaning 20 tons of gray iron agricultural castings daily and replaced five large tumbling mills.

SAVED **$ 10,104** YEARLY

CASE HISTORY No. 8 **Lennox Furnace Co.** eliminated 9 tumbling mills, handling gray iron furnace castings, with a 48" x 42" Wheelabrator Tumblast.

SAVED **$ 8,960** YEARLY

CASE HISTORY No. 9 **The Majestic Co.** cleaning fragile gray iron building products and furnace castings, eliminated a battery of tumbling mills with a 66" Wheelabrator Swing Table.

SAVED **$ 9,525** YEARLY

CASE HISTORY No. 10 **The Auto Stove Works** installed a 36" x 42" Wheelabrator Tumblast for cleaning 13 tons of gray iron stove castings daily and replaced 8 tumbling mills.

SAVED **$ 4,775** YEARLY

WHEELABRATOR & EQUIPMENT CORP.

405 S. Byrkit Street Mishawaka 2, Indiana

FEMA

PLEASE TURN PAGE

American SANDCUTTER

SLASHES SAND CONDITIONING COSTS . . . BOOSTS EFFICIENCY

at Enardo Foundry and Manufacturing Co., Tulsa, Okla.

Here is what M. C. Helander, Production Sup't. says:

"Before the purchase of the American Sandcutter, we had a large crew of men cutting our sand by hand, one man mulling facing sand all night and one man doing the same all day; at that, we had a lot of lost molding time because these two men could not keep up. Now one man with the SANDCUTTER cuts all our sand including the facing, which previously took two alone."

SANDCUTTER reduces the cost of sand conditioning because it is faster and requires less labor, and no hand shovelling. The whirling blades condition sand for fast, economical molding. Write today for complete information on how you can have better sand, and better castings, at lower cost . . . with a SANDCUTTER.

"TRU-STEEL SHOT

lasts 5 to 6 times as long"

says Peter B. McCurdy of Gray Forgings & Stampings Ltd.

"We find TRU-STEEL SHOT lasts from 5 to 6 times as long as ordinary shot. Blades used to last at the most 50 Wheel hours with ordinary shot — with TRU-STEEL approximately 400 hours. Our wheel has been operating over 800 hours at this point perfectly satisfactorily. In general TRU-STEEL costs half as much as ordinary shot, cuts down on maintenance and costly parts with less handling and storage."

Perfected TRU-STEEL SHOT has no equal for economy and performance. It is new and different — a genuine true steel that has received a full heat treatment, not just a draw or anneal. You can expect top performance and real economy from TRU-STEEL because of these exclusive features: it is round and solid — hard and tough — fully heat treated — wears down, but does not break down — accurately graded and controlled as to quality and hardness. Write for Bulletin No. 59.

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American WHEELABRATOR & EQUIPMENT CO

505 S. Byrkit St., Mishawaka 2, Ind.

AO Foundry Goggles — Dust Goggles

NOW...

AO Foundry and Dust Goggles with easily sterilized, perspiration-resistant PLASTIC FACE MASKS

305 Foundry Goggle

AO presents the improved 305 (NFA) Foundry Goggle and the new 306 Dust Goggle with new face masks of vinyl plastic that RESIST SHRINKAGE, CURLING OR HARDENING FROM PERSPIRATION. The new plastic mask retains its factory pliability after use. Even after sterilizing it maintains its original shape and flexibility. Because perspiration acids do not affect it, mask life is extended appreciably. Another new feature, a soft corduroy binding with sponge rubber pad inside, extends around the entire edge of the mask — provides unusual comfort and snug fit. Your nearest AO Safety Products Representative can supply you.

Quick Facts

FOUNDRY GOGGLE

(For protection against sparks and impact hazards)

- Excellent ventilation from large wire screen area around eyecups
- Super Armorplate or 6 Curve Super Armorplate clear or Calobar lenses in medium, dark or extra dark shades
- Headband of one-piece rubber, easily adjustable

DUST GOGGLE

(For protection against fine dusts and powders)

- **Exceptional wide angle vision**—deep set eyecups permit broad view of working area
- **Ample ventilation**—wire screen ventilators keep out sparks and flying objects
- **Assured safety**—150 mesh screen behind 16 mesh wire screens out fine dust particles and powder
- Super Armorplate clear or Calobar lenses. Medium, dark or extra dark.

American Optical COMPANY
SAFETY PRODUCTS DIVISION

Southbridge, Massachusetts • Branches in Principal Cities

SIMONDS
ABRASIVE CO.

Grinding Wheels

for low cost snagging

Fast stock removal at low cost! It's yours with Simonds Grinding Wheels on your swing frame and floor stand grinders . . . biting into the toughest metals . . . standing up to the severest strain of rough snagging . . . giving maximum tonnage ground.

Special advantages of exclusive patented Red Streak Flanges on large hole resinoid bonded wheels assure extra savings through less machine wear and lower maintenance cost. Find out how this efficiency can be yours on every grinding job. Write for informative Data Book listing your nearest Simonds Abrasive distributor.

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA. DISTRIBUTORS IN PRINCIPAL CITIES

DIVISION OF SIMONDS SAW AND STEEL CO., FITCHBURG, MASS. OTHER SIMONDS COMPANIES: SIMONDS STEEL MILLS, LOCKPORT, N.Y., SIMONDS CANADA SAW CO., LTD., MONTREAL, QUE. AND SIMONDS CANADA ABRASIVE CO., LTD., ARVIDA, QUE.

A NEW ERA IN PATCHING CUPOLA LININGS WITH the BONDACT Process.

IT'S NEW • IT'S REVOLUTIONARY • IT'S FAR BETTER

The Bondactor is a pressurized machine which meters and feeds a dry refractory mixture at almost any desired rate or volume at any location convenient to an air line or air compressor, feeding uniformly and without pulsation.

REVOLUTIONIZES PATCHING AND LINING OF CUPOLAS...

No more hard and soft spots due to uneven patching! Steady, uniform feeding saves hard manual labor and lines your cupola, ladle or furnace in ¼ to ½ the time heretofore required, greatly reducing down time. Your lining has maximum density and maximum refractory life. You have full control over moisture content, which is low, over density of patch and contour of patch. Extensive aging of monolithic materials is no longer necessary; storage space is reduced. Since Bondactor delivers unusual density and strength, you can use the highest quality ganisters with minimum clay and water content. Finally, you get low burn-out, uniform burn-out per day, uniform melting conditions and better all-around cupola performance. Why not see what the proven Bondact process will do for you?

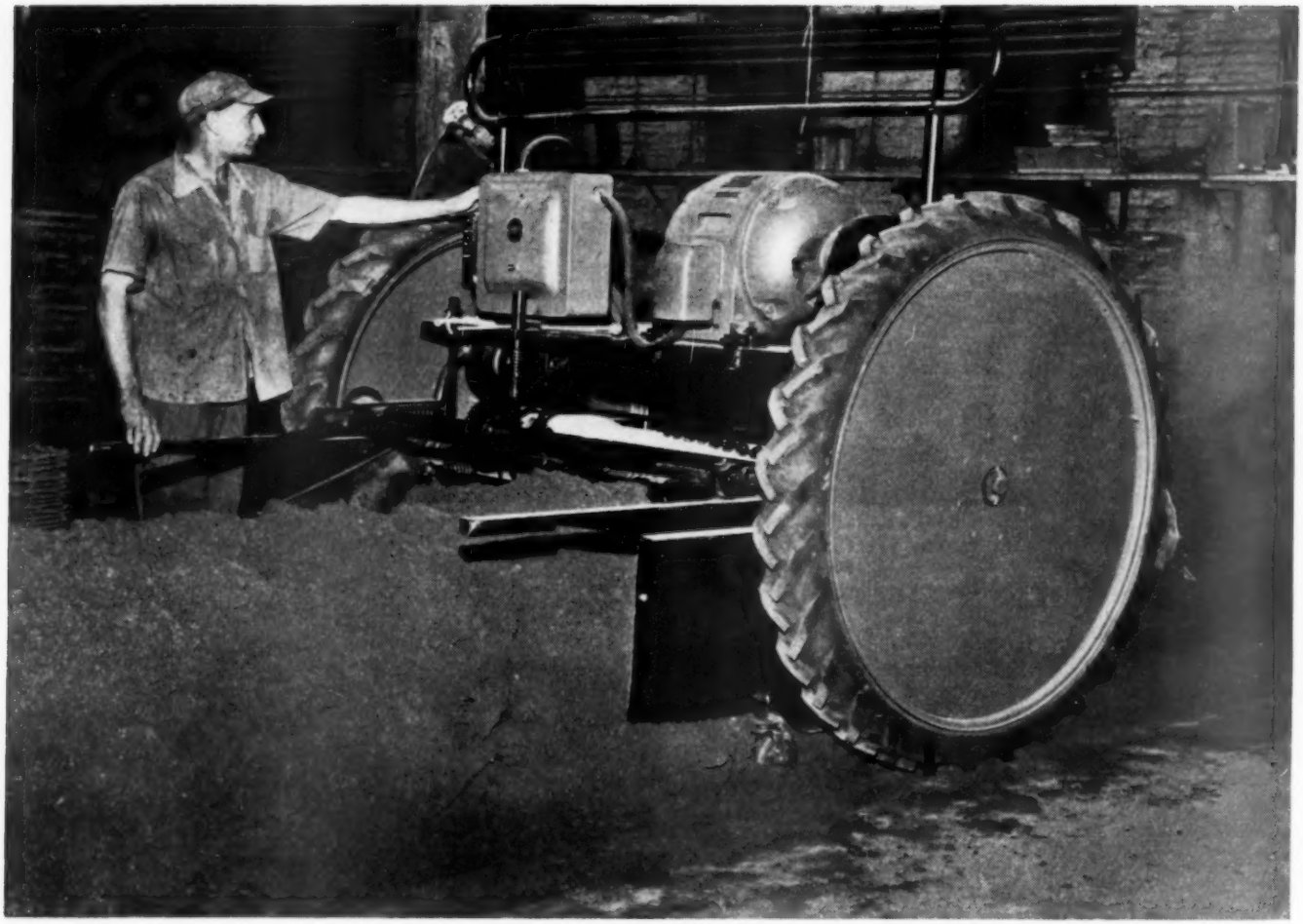
Ask for our well illustrated 8-page Bulletin "F".

EASTERN CLAY PRODUCTS, INC., JACKSON, OHIO

DIXIE BOND • BLACK HILLS BENTONITE • REVIVO BOND • REVIVO SUPER BOND • BALANCED REVIVO

ECP *All* TYPES OF BONDING CLAYS

A Foundry Sand Service Based Upon Practical Research



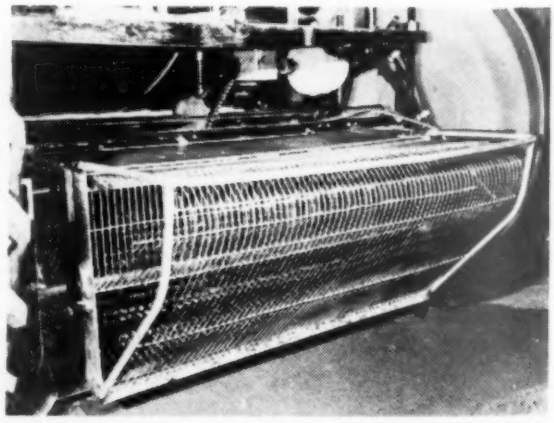
"The Moulders' Friend" **conditioning more than two tons of sand per minute in a Pennsylvania foundry.**

"The Moulders' Friend" **Fits Your Foundry.** Carried on two large pneumatic tired wheels, it rolls easy and turns short in the crowded foundry under the complete control of one man—No experience required to operate—Saves labor shoveling.

"The Moulders' Friend" **Improves the Condition of Your Sand Heaps.** The brush does the job. Thousands of flat tempered steel wires in the brush revolving at high speed pick up small particles of the used sand, added bond and moisture and blend them thoroughly. The action is so thorough that clay bond and water can be blended with the sand in one trip over the heap.

"The Moulders' Friend" **Is Easy to Buy and Maintain.** Simplicity of construction with few moving parts keeps down original and replacement costs. High speed chain drives run in dirt proof, oil tight cases.

Investigate this remarkable machine. May we arrange a demonstration? If you want satisfied moulders making quality castings write us now.



Remove trash and tramp iron from your sand heaps with this screen attached to your Moulders' Friend.

"The Moulders' Friend", **Dallas City, Ill.**

CHAPLETS

STEEL FLASKS

FLASK PINS AND BUSHINGS

Foundrymen have learned there will be no spoiled castings due to faulty Chaplets if they standardize on Shanafelt 'Seal-Tytes.'

Materials are metallurgically correct for thorough fusing in the casting. Uniformity in size of heads and stems is maintained by careful inspection. A full metallic coating keeps them rust proof while in your stock bins.

We specialize in double heads and keep large stocks of most sizes for immediate delivery.

For 27 years Shanafelt steel Flasks have been helping foundries pour good castings.

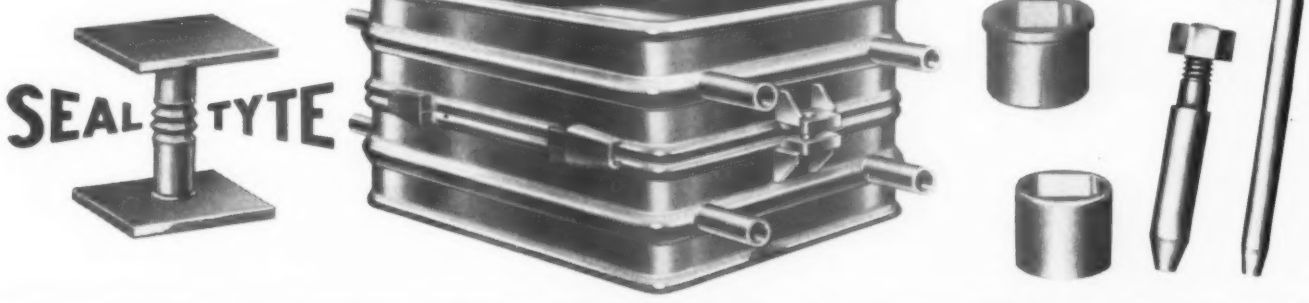
The Shanafelt Flask is strong, accurate, and long wearing, yet light in weight for easy handling.

If you have never used Shanafelt Flasks, it will pay you to give them a trial—see for yourself how well they perform under your own production conditions.

Shanafelt hardened steel Pins and Bushings are made for smooth and fast line up of the Flask sections.

Many years of Flask experience have taught us how they must be made to deliver results under today's high speed foundry operations.

Regardless of what Flask you are using, you'll make no mistake replacing worn bushings and pins with precision-made Shanafelts.



Dependable SHANAFELT Products

SERVING THE FOUNDRY INDUSTRY FOR OVER 57 YEARS . . . . .

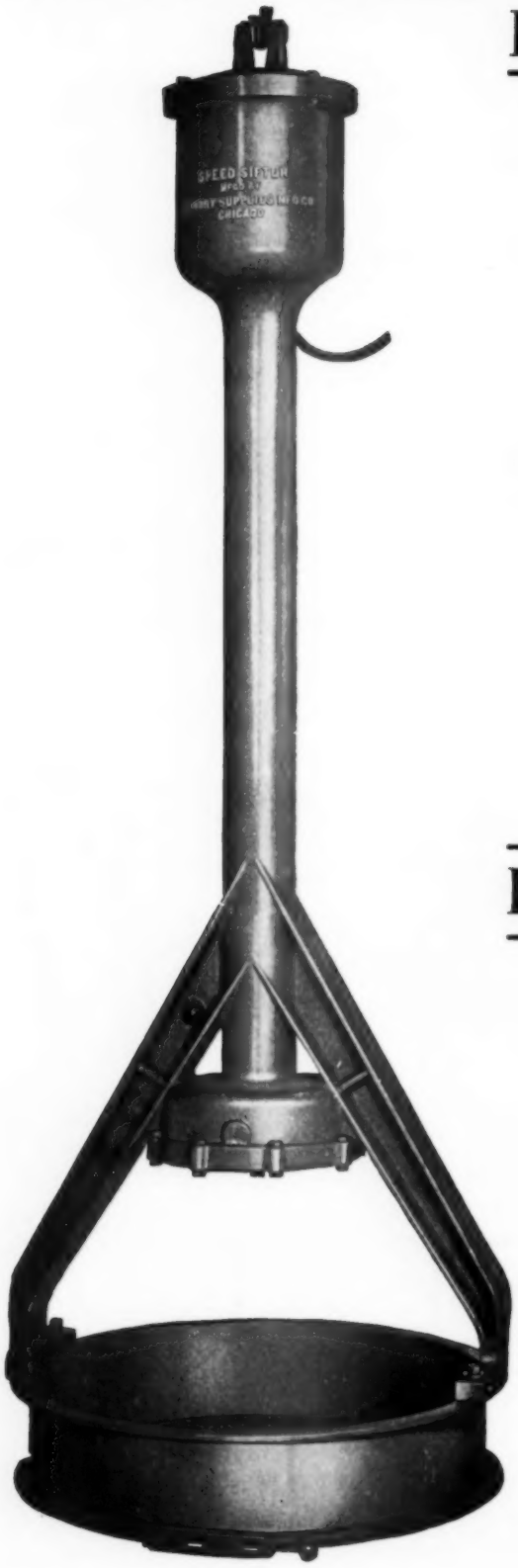
THE SHANAFELT MANUFACTURING CO., CANTON, OHIO

2600-2700 WINFIELD WAY N. E.

Increase Production

with the

ROTOPLANE SPEED SIFTER ★ RED ELECTRIC VIBRATORS



ROTOPLANE SPEED SIFTER

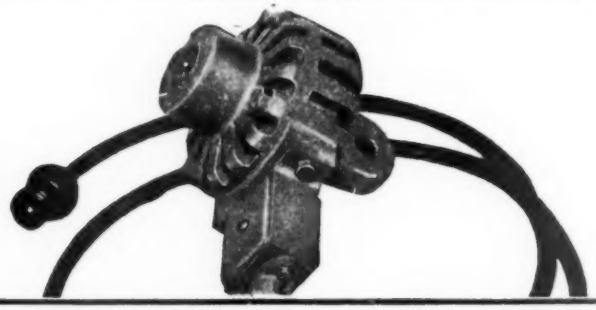
The ROTOPLANE Speed Sifter is an *improved* sand riddle of much greater capacity and much longer life. One size and type serves all purposes in the foundry—does *all* your sifting more quickly and economically.

It is easily handled by one man, weighs approx. 90 lbs., is 62 in. high overall. The one-piece frame of tough aluminum alloy makes for a remarkably effective vibration. Its smooth, free, rotary action vastly increases bearing life; all bearings grease packed. All mechanism of the ROTOPLANE is *completely* enclosed—no bearings or activating parts of any kind exposed to dust and grit.

The Quick-Change Sieves are instantly interchangeable, mounted in smooth, flat steel ferrule, with 20-inch diameter clear sifting area. No jagged edges to tear workers' hands, no storage problem.

$245.00 f.o.b. Chicago—complete with cable, safety ground wire. Standard 1/3 h. p. motor, 110 volt, 60 cycle, single phase and 220 volt, 1 or 3 phase.

UNIVERSAL FREE - WHEELING RIDDLE equipped with motor as above $225.00



RED ELECTRIC VIBRATORS

True-to-pattern castings make satisfied customers . . . more repeat business. Increase your production and castings quality with RED Electric Vibrators. Sturdy, dustproof, lowest operating cost (electricity does not freeze). Unequaled for consistent year-'round results in foundries all over the world.

(All Prices f.o.b. Chicago)

No. 1—Light match plate work	$11.00
No. 2—Medium match plate work	13.60
No. 5—Heavy match plate, tub and bench work	18.40
No. 9—Machine and heavier work	26.80

Third (ground) wire per U. S. Govt. code—furnished with No. 9 at no extra cost; $1.20 extra with Nos. 1, 2 and 5 vibrators.

KNEE SWITCHES for operating Red Electric Vibrators: Single pole $5.00, Double pole $6.50.

FOUNDRY SUPPLIES MANUFACTURING CO.

2221 Orchard Street **Chicago, Illinois**

CABLE ADDRESS: "ROTOPLANE CHICAGO"

PAYLOADERS Save Time and Money on these Jobs

How do You handle them?

Unload box cars.

Carry sand, coke, scrap, limestone, etc., to storage.

Transport materials to cupola.

Transport and distribute sand to molding stations.

Windrow sand for the cutter.

Remove used sand from floors.

Charge mullers, hoppers, tumbling barrels.

Feed conveyors, elevators, mixers, screenerators.

Remove cupola drops.

Load trucks.

Dispose of old sand, cores and other waste.

Handle scrap and small castings.

Clean up gangways, aisles and other areas.

Load charge boxes.

Load out trash, debris.

Level dumps — dig and grade.

Maintain private roadways.

Handle coal, ashes, cinders.

Do crane work — haul, push.

Remove snow.

Hundreds of Payloaders in Foundries are cutting casting costs by saving time, manual labor and money doing jobs that used to be dirty, back-breaking and costly. One man on a Payloader does a variety of loose and bulk material handling jobs faster, easier and cheaper.

They pick up, carry, pile, spread, windrow, dump, unload and load sand . . . handle sprues, slag, bond and broken cores . . . work indoors and out . . . go right to work saving dollars immediately because no expensive and time-consuming changes in plant layout or equipment are required.

If Payloaders are not yet cutting costs in your foundry get the full story from your Hough Payloader distributor, or write The Frank G. Hough Co., 703 Sunnyside Ave., Libertyville, Ill.

Send for Job Study No. 10 — it's full of authorized facts and photos on how one foundry cut costs with Payloaders.

SAY "HUFF"

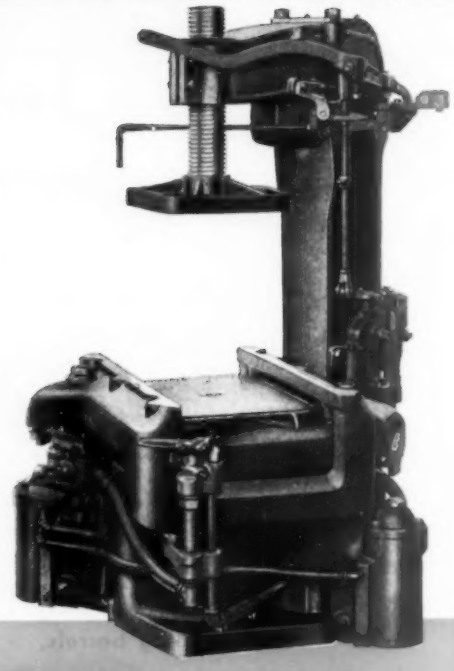
HOUGH
PAYLOADER
Manufactured by THE FRANK G. HOUGH CO.

MILWAUKEE JOLT SQUEEZE STRIPPERS

Deliver UNIFORM MOLDS *with* FEWER JOLTS

and *FASTER!*

You'll like these Strippers for your foundry because they really speed up mold production. Every blow struck by the massive jolt table is a true packing blow. Because the anvil is located directly under the jolt table, piston wear cannot affect jolting efficiency. A big capacity poppet valve allows the squeeze piston to move up at high speed for maximum impact against the squeeze head. The squeeze is always parallel. On the Arm-type model, two machined bearings on squeeze arm square up against two matching surfaces on back frame. Cast steel frame and arm are big and heavy, designed to take heaviest impact.



ARM TYPE STRIPPER

Control levers are placed right for fast operation. Pattern draw is fully automatic. Moving squeeze arm is easy because arm rides on roller bearings. All working adjustments can be made by operator without aid of mechanic. Location of squeeze arm lever keeps operator's hands in a safe zone above flask line. Safety latch locks the arm during jolting operation and the mold cannot be squeezed until the platen is in proper squeeze position.

CAR TYPE STRIPPER

The molding machine that's equipped with car suspended squeeze platen for automatic overhead mold removal. Pattern drawing mechanism operates automatically when squeezing pressure is released. Extremely simple in design.

CORE BLOWERS • CORE GRINDERS • MOLDING MACHINES • BRIQUETTING PRESSES

MILWAUKEE *Foundry Equipment*

Division of SPO Inc.

3236 W. PIERCE STREET, MILWAUKEE 15, WISCONSIN, U.S.A.

TO HELP YOU PRODUCE

High-Quality Iron

FREE BOOKLET TELLS HOW CUPOLA ADDITIONS OF ALLOYS IMPROVE FOUNDRY PRACTICE

This new booklet describes in detail:

- How ferro-alloys control the composition of iron and compensate for variations in raw materials.
- The beneficial effects of silicon, manganese, and chromium in cast iron.
- Advantages in using ferro alloy briquets.
- How to calculate the number of briquets to add to the charge.
- How to control carbon, sulphur, and phosphorus.
- Typical cupola charges for soft gray iron, high-strength iron, and low-chromium iron.

24 pages, including tables showing standard cupola charges and iron composition. A real help to all foundrymen.

ELECTRO METALLURGICAL DIVISION
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Union Carbide and Carbon Corporation
30 East 42nd Street, Room 1813
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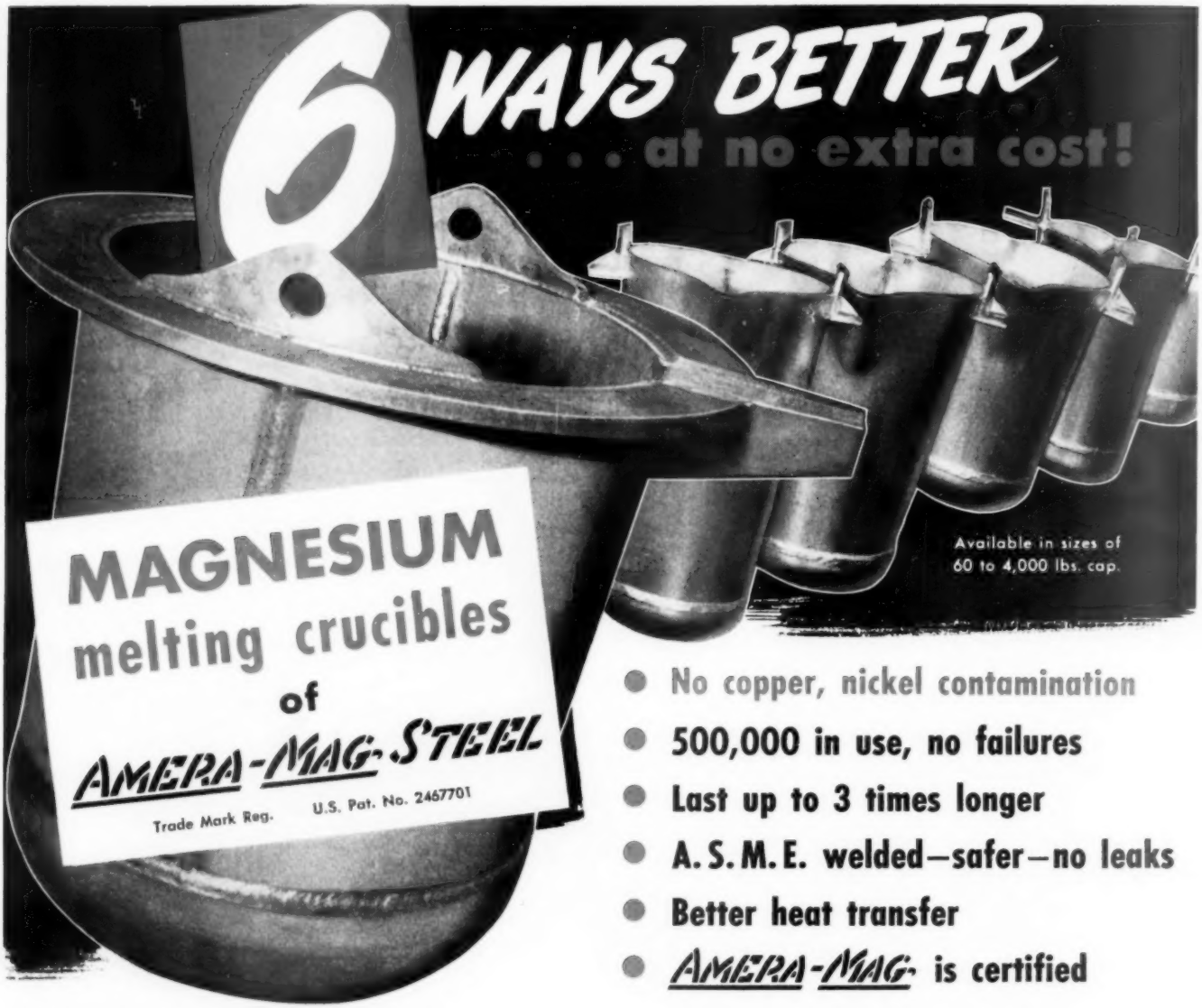
Please send me, without obligation, a copy of "Briquetted Alloys for the Iron Foundry Industry."

Name ..... Title .....

Company .....

Address .....



- No copper, nickel contamination
- 500,000 in use, no failures
- Last up to 3 times longer
- A. S. M. E. welded—safer—no leaks
- Better heat transfer
- AMERA-MAG- is certified

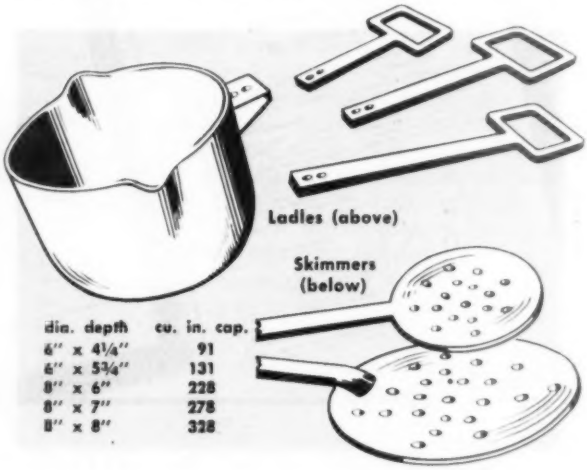
AMERA-MAG- crucibles, ladles, skimmers outperform them all

Latest triumph of metallurgy—tough, fine-grained AMERA-MAG steel has qualities that make it best news for magnesium foundrymen in years!

AMERA-MAG Crucibles—Designed for magnesium. No copper, nickel contamination. Formed and welded—lighter, easier handling, yet safer and longer lasting. Resist thermal shock, high-heat and distortion. No cracks or leaks. Retard scaling. Tested, proven vastly superior to cast crucibles, **yet cost no more.**

AMERA-MAG Ladles—Have interchangeable handles. Durable, pressed steel construction—deep drawn to avoid spilling. Spouts designed for proper pouring. Lightweight—less operator fatigue. Spherical bottom reduces metal adherance—easy to clean.

AMERA-MAG Skimmers—Order now for early delivery with your new AMERA-MAG crucibles and ladles. For complete information, write or wire . . .

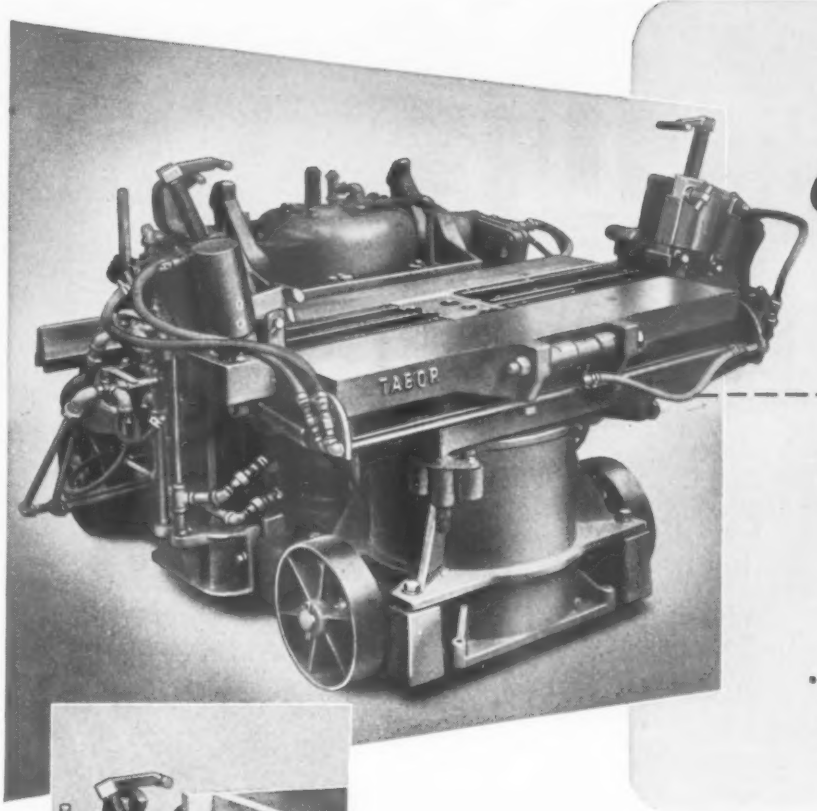


dia.	depth	cu. in. cap.
6"	4¼"	91
6"	5¾"	131
8"	6"	228
8"	7"	278
8"	8"	328

THE American TANK & FABRICATING CO.

John J. Ripich, President • K. J. Humberstone, Chief Metallurgist

2284 SCRANTON ROAD CLEVELAND 13, OHIO

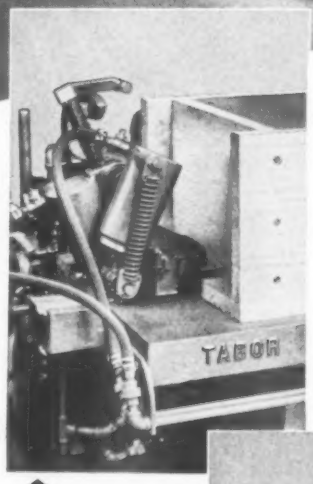


And Now...

TABOR
TRADE 1884 MARK

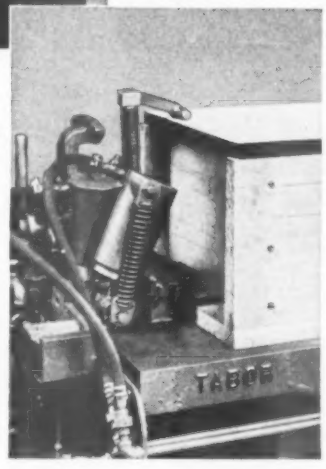
jar, power rollover, power draw *Machines*

..WITH THE NEW QUICK CHANGE-OVER TABLE*



Core box clamped

Core box and core plate clamped ▶



*Can easily be installed in your present Tabor rollover machine if its capacity is within the range of 600 to 3000 pounds.

IT'S a Tabor innovation! The new plate design permits *independent* setting of all four clamps. Always big producers, these machines now lend themselves to exceptionally rapid change-over—become invaluable in either core room or jobbing shop where pattern changes are frequent.

Designed to produce the larger cores—the jobbing shop molds, these machines are furnished either plain jar or shockless. The latter is recommended for upper-floor installation—for freedom from vibration and consequent damage to completed cores.

TABLE OF STANDARD SIZES

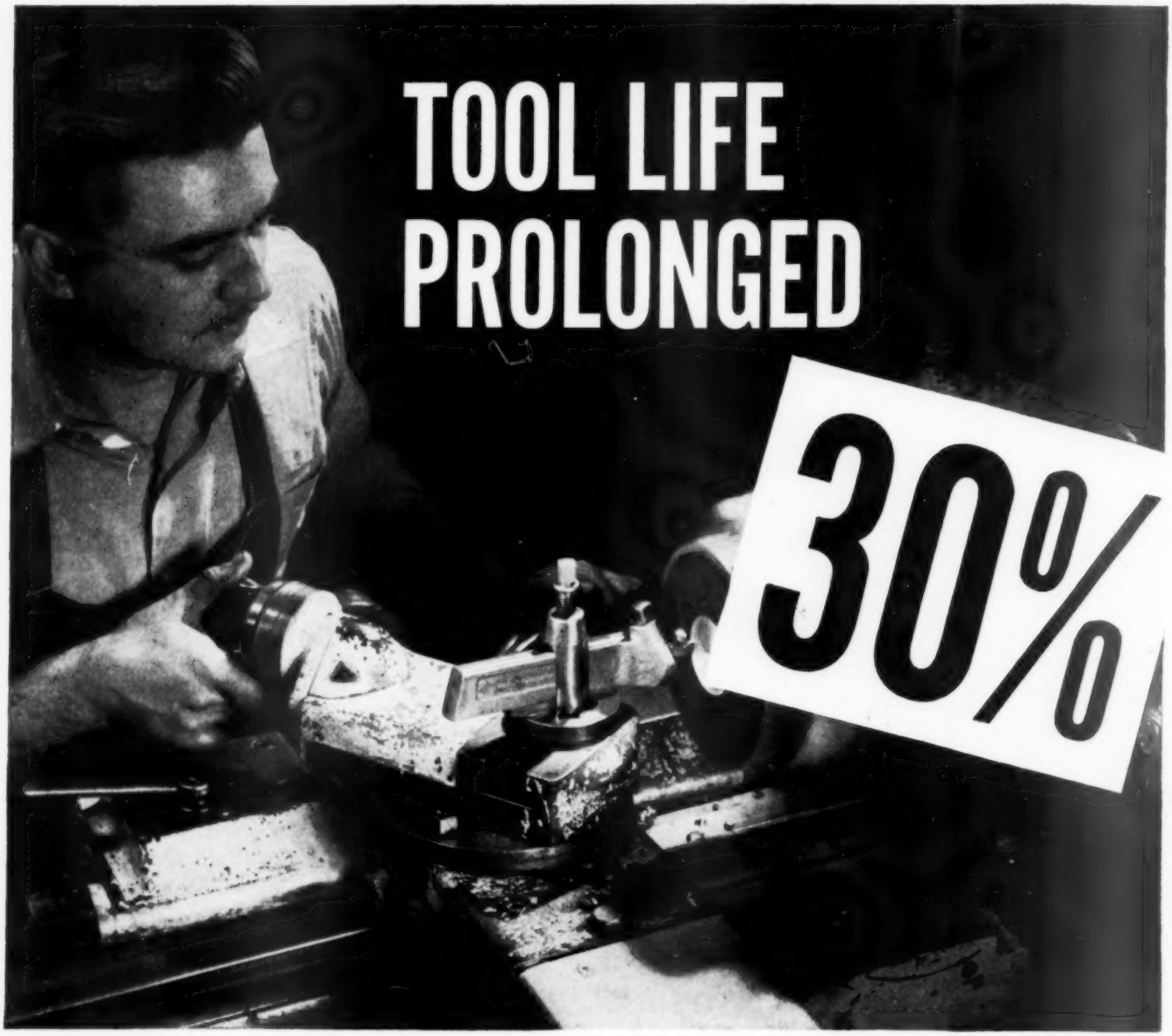
Size of Machine	Width of Core Box or Flask		Length of Core Box or Flask		Height—including core plate	
	Min.	Max.	Min.	Max.	Min.	Max.
22"	10"	22"	20"	40"	7½"	14"
30"	15"	30"	26"	46"	8"	18"
40"	20"	40"	28"	56"	12"	25"

REPRESENTATIVES
Snyder Foundry Supply Company, Los Angeles, Calif.; The PacificGraphiteCompany,Inc., 40th & Linden Sts., Oakland 8, Calif.; Carl F. Miller & Company, Seattle, Washington; M. W. Warren Coke Company, 1017 Olive Street, St. Louis 1, Mo.; E. R. Frost Company, Inc., Minneapolis 14, Minn.; Harry H. Reich, Trussville, Ala.

MANUFACTURER'S ASSOCIATION INC. FOUNDRY EQUIPMENT

The TABOR Manufacturing Co.

SINCE 1884 MANUFACTURERS OF FOUNDRY MOLDING MACHINES
6225 TACONY STREET • PHILADELPHIA 35, PENNA.



By using FERROCARBO Silicon Carbide briquettes to deoxidize cast iron, it has been found that machinability has been improved to the extent that tools last practically one-third longer. Our metallurgical staff will be pleased to supply complete details or you may obtain the facts by writing direct.

FERROCARBO Briquettes

BY CARBORUNDUM
TRADE MARK

THE CARBORUNDUM COMPANY, Bonded Products and Abrasive Grain Division, Niagara Falls, New York

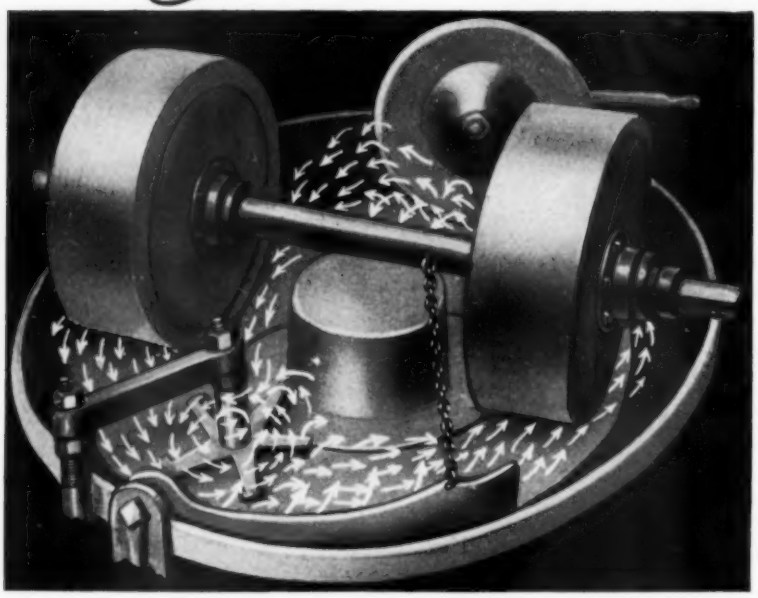
FERROCARBO Distributors: Ketchner, Marshall & Co., Pittsburgh, Cleveland, Birmingham, Philadelphia and Buffalo; Miller and Company, Chicago, St. Louis and Cincinnati

"Carborundum" and "Ferrocarbo" are registered trademarks which indicate manufacture by The Carborundum Company

LINE-UP TROUBLES DISAPPEAR
with UNIVERSAL
FLASK PINS AND BUSHINGS
FOR COPE AND DRAG
Accurate and speedy lineup of cope and drag, saving valuable production minutes, is the experience of the foundry that uses Universal Flask Pins and Bushings. Once installed, they maintain their stability and accuracy for hundreds of castings. Cope Bushings are quickly guided to Drag Pins over tapered, loose-fitting Closing Pins which are easily removed after assembly. The special elongated flask bushing permits longitudinal expansion to compensate for metal heat without affecting accurate alignment. Universal Flask Pins and Bushings are available from stock in standard sizes for iron, steel, aluminum and magnesium flasks. Special sizes and types to order. Send for folder and complete information.
UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 4, MICHIGAN

THE *Clearfield* MIXER

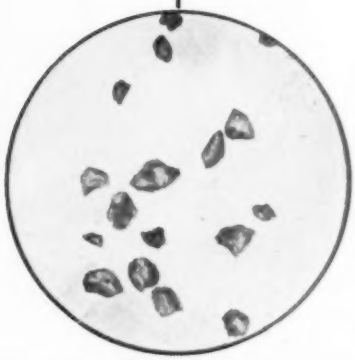
prepares better foundry sand

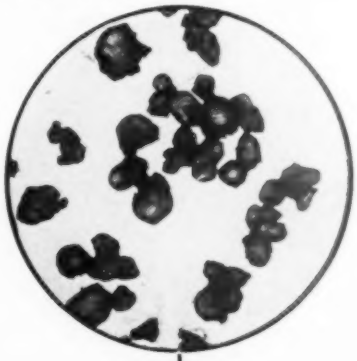


Foundry sand is composed of three principal elements, silica grains, bond and moisture. The quality of this sand depends in major part upon how well these three elements are blended. Therein lies the explanation of the outstanding performances of Clearfield Mixers.

Clearfield Mixers employ the revolving pan principle of sand preparation. The mullers are mounted on a floating shaft and revolve by contact with the moving sand. Centrifugal force together with the stirring action of the agitator and disc transform the sand from an inert mass into a fluid moving stream. The result is a perfect blend of the three elements—and foundry sand that does its job perfectly.

There's a Clearfield Mixer which will meet all your sand preparation needs. Write today for Catalog No. 79 for complete details.





VISUAL EVIDENCE of the effectiveness of Clearfield Mixers is provided by these photomicrographs. Above, unbonded silica sand. Below, the same sand bonded in a Clearfield Mixer.

CLEARFIELD MIXER

MIXES, TEMPERS AERATES

CLEARFIELD MACHINE COMPANY

CLEARFIELD PENNSYLVANIA, U. S. A.

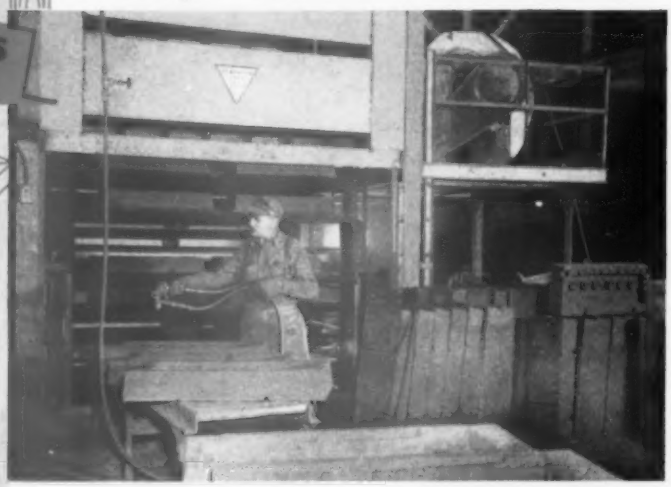
New DESPATCH Vertical Foundry Oven

Cuts Production Costs

Says MARATHON FOUNDRY

HERE'S WHY

High volume forced convection heating system with cross flow of heated air from heat duct through center of oven directs heat to every inch of the bake zone to permit accurate control of heat and air for proper preheating and baking of all cores. This assures more uniform baking, higher quality and fewer rejects. Up to 75% of heated air is recirculated which saves fuel. Balance is exhausted at top of oven carrying away objectionable fumes. Vertical oven construction saves floor space and arrangement of core racks on vertical conveyor subjects all cores to identical baking and cooling cycles. The oven is fired by a direct oil heater.



Cleaning cylinder head cores with an air blast after baking in a Despatch Vertical Oven at Marathon.

Loading cylinder head cores into a Despatch Vertical Core Oven at the Marathon Foundry.

Marathon Foundry and Machine Company of Wausau, Wisconsin, producers of Diesel cylinder heads and manifolds, report the following production achievements after installation of a DESPATCH VERTICAL CORE BAKING OVEN:

- **60% Increase in Production over previous method.**
- **30% Lower Maintenance Costs.**
- **Even Baking assuring higher quality cores.**
- **Notable Saving in Scrap because of better baking efficiency.**
- **Trouble-free Operation at all times.**

The Marathon Foundry uses about 35 tons of core sand daily and is now producing 525 cope and drag cylinder head body cores in a 16-hour day. They attribute this fine production record to the efficient, economical and labor-saving operation of their Despatch Oven installation.

DESPATCH FEATURES ASSURE FAST, UNIFORM CORE BAKING AT LOWER COST

INCREASED PRODUCTION! 100% convection heat and up to 75% recirculated air give you speedy warm-up, fast heat recovery after re-loading and fast baking.

QUALITY BAKING! Heavy-duty, hi-volume fans give speedy heat transfer, assure uniform baking. Equipped with automatic temperature controls and fire underwriters' approved safety system.

EFFICIENT OPERATION! DESPATCH direct gas or oil fired heaters cut fuel costs . . . ease of loading saves time and labor . . . compactness saves floor space.

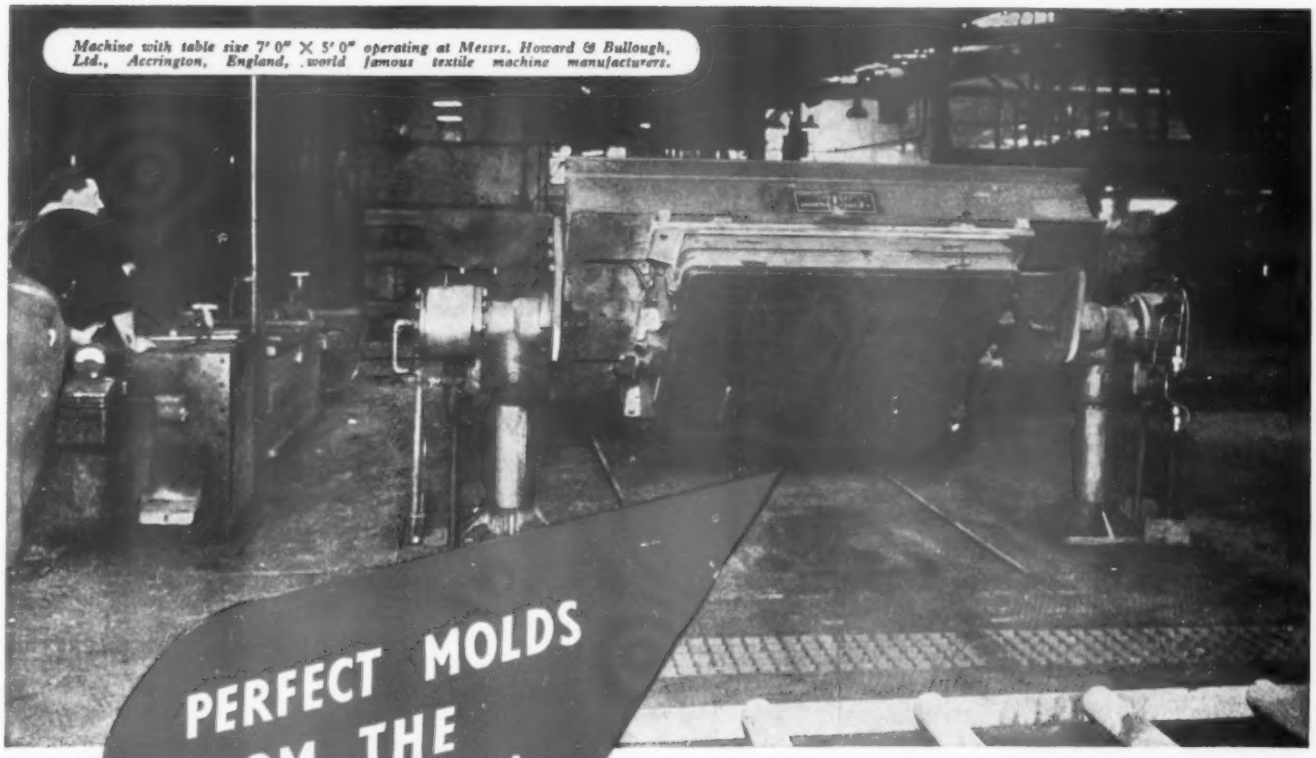
WRITE TODAY for Bulletin 30 or request a representative to call.

MINNEAPOLIS OFFICE: 619 S. E. Eighth Street
CHICAGO OFFICE: 7070 N. Clark Street

DESPATCH OVEN COMPANY

International GRAPHITE AND ELECTRODE CORP.
ST. MARYS, PA.

5921



Machine with table size 7' 0" × 5' 0" operating at Messrs. Howard & Bullough, Ltd., Accrington, England, world famous textile machine manufacturers.

PERFECT MOLDS FROM THE SANDSLINGER'S COMPANION!

★ AUTOMATIC CLAMPING OF PATTERN PLATE AND BOX

★ PERFECTLY ACCURATE DEEP PATTERN DRAW

★ LOW RAMMING HEIGHT

★ SELF CONTAINED ELECTRO-HYDRAULIC UNIT

★ ALL MOVING PARTS IN OIL

Type WT.200 Hydra Molding Machine is specially designed to work in conjunction with the Sandslinger unit. It enables the molds to be turned over and the pattern draw made in the shortest possible time.

The Self Contained Electro-Hydraulic Unit has many advantages over pneumatically operated machines, including a hermetically sealed oil circuit, enabling all moving parts to operate in oil, also excluding sand and thus reducing maintenance to an absolute minimum. The oil pressure is variable and simply adjusted to suit different size molding boxes. This ensures economic operation. Pressure fluctuation is eliminated and a perfectly smooth pattern draw results. The machine is designed with a very low ramming height, the machine table being only 18" from ground level. Machines are constructed to suit client's individual requirements and include table sizes of 13' 0" x 8' 0".

MADE IN ENGLAND

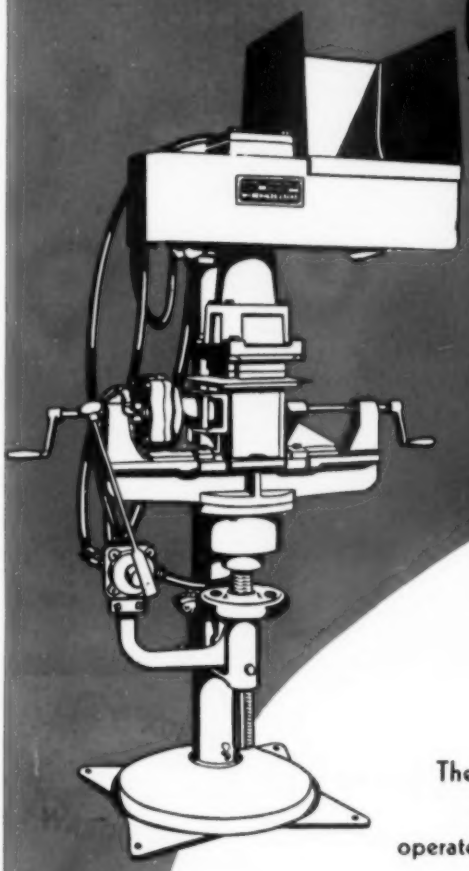
STONE-WALLWORK *Foundry Equipment*

Stone-Wallwork equipment operates in 18 different countries. The range of products include complete mechanical plants, Push Button Controlled Molding Machines, and a special range of machines for operating in conjunction with the sand-slinger unit.

STONE-WALLWORK LTD., 137, VICTORIA STREET, LONDON, ENGLAND

GREATER PROFITS FOR YOU

DEMMLER CORE BLOWERS



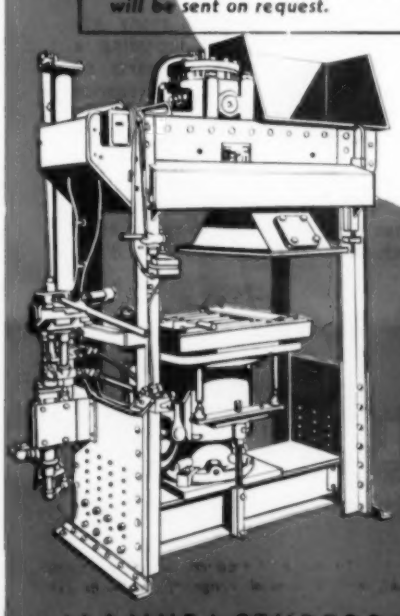
No. 55 CORE BLOWER IS A PROVEN MONEY MAKER

You, too, can boost your profit margin through increased production of high quality small cores. The DEMMLER No. 55 small core blower is ideal for short run jobs—a proven money maker in foundries of every size.

A quality machine throughout, the DEMMLER No. 55 can be counted upon for years of dependable service.

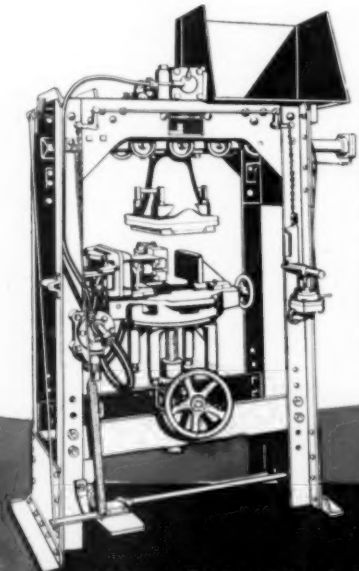
The No. 55 will blow cores weighing up to four pounds, will accommodate boxes nine inches long. Machine has both vertical and horizontal air operated core box clamps, automatically controlled by the same valve that blows the core. Simple in construction and operation, the DEMMLER No. 55 core blower represents one of the greatest values . . . one of the soundest investments in the core blowing field today

Free illustrated specification sheets on any of the three DEMMLER Core Blowers shown will be sent on request.



DEMMLER No. 2E

For use on cores which can be blown to advantage by attacking top half of core box to blow plate and drawing core on machine. Draws of extreme accuracy assured.



DEMMLER No. 1

Here's a truly versatile, general purpose core blower. Blows cores up to eight pounds in weight, has quick job changing features, one of the best known, and liked, machines in the field.

Wm. DEMMLER & BROS.
KEWANEE, ILLINOIS

MANUFACTURERS OF CORE BLOWERS EXCLUSIVELY SINCE 1911

Conditions 200 tons of Molding Sand Daily!

THIS SMALL RIPL-FLO SCREEN aerates, cools and breaks lumps—handles over 200 tons of mulled molding sand daily in a large midwest foundry. It is a 3 x 8 ft. screen with 1 x 3½ in. openings on the top deck; ¾ x 3 in. openings on the second deck. Forced air passing upward through the screen lowers sand temperature to 30-40° above room temperature. Patterns draw better; molds are smoother; screened sand flows freely in hoppers and chutes.

Here are three good reasons why *Ripl-Flo* foundry screens may fit in *your* sand conditioning operation:

1. UNIFORM VIBRATION OVER ENTIRE SCREEN! Circular motion plus sloping deck of *Ripl-Flo* screens enable you to screen sand uniformly according to your molding specifications.

2. LOW POWER CONSUMPTION! Two-bearing design eliminates superfluous parts — such as unnecessary outer bearings, stationary support frames. Weight is reduced 36% from similar size 4-bearing screens. You actually *save* out of every power dollar you spend on a *Ripl-Flo* screen!

3. LOW INITIAL AND MAINTENANCE COSTS! Costs less than conventional 4-bearing screens because superfluous parts are eliminated. Initial price includes built-on sheave, discharge spouts you'd buy as "extras" elsewhere.

Your requirements can be met by one of 15 sizes of *Ripl-Flo* screens ranging from 3 x 6 ft to 6 x 16 ft with single or double decks. For complete information, call your nearby Allis-Chalmers office or write for Bulletin B6151B. A-2888

ALLIS-CHALMERS, 1032A SO. 70 ST.
MILWAUKEE, WIS.

A-C ALLIS-CHALMERS

Ripl-Flo, Foundromatic and *Regulex* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

Foundry Equipment for Bigger Output-Better Working Conditions!

Foundrymen who look at binders—

without BLINDERS

...see these big reasons for using CYCOR* 151

IT PAYS to switch from the conventional binders to Cyanamid's improved synthetic resin binder, CYCOR 151, for sand cores. Just make this comparison yourself and see.

You'll find that...

CYCOR 151 bakes in faster time—at lower temperatures... produces more uniformly high-quality cores per oven.

You get unusually good collapsibility... with less cleaning required.

CYCOR 151 costs no more than standard binders, yet saves you money because you purchase only the neat synthetic resin, modifying it with fillers and extenders to meet your special requirements.

You'll find, in short, that CYCOR 151 is what you have been looking for. Write for further information. Plastics Department, American Cyanamid Company, 38C Rockefeller Plaza, New York 20, N. Y.

*Reg. U. S. Pat. Off.

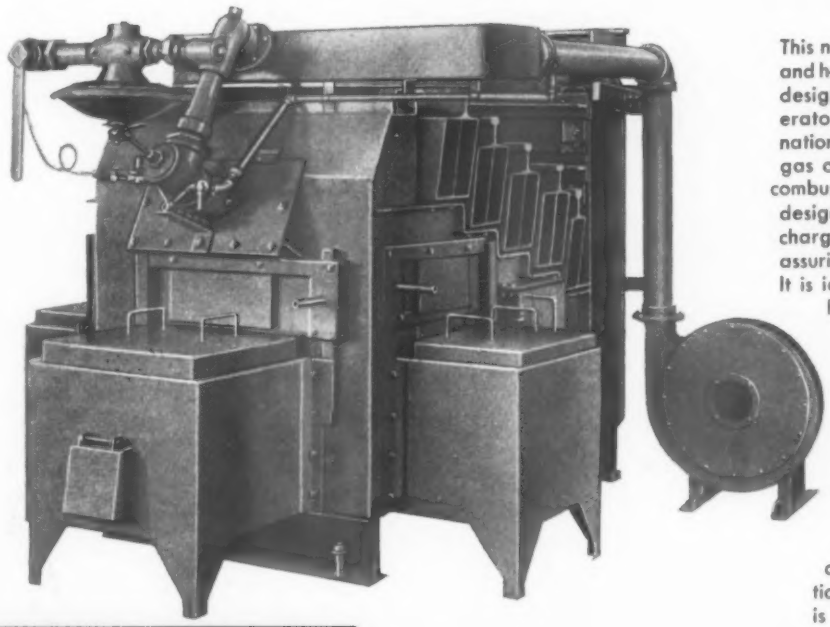
AMERICAN Cyanamid COMPANY

PLASTICS DEPARTMENT

38C ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

ATTENTION ALUMINUM MELTERS!

Here's the NEW Stroman Model MC Aluminum Reverberatory Dip-Out Furnace



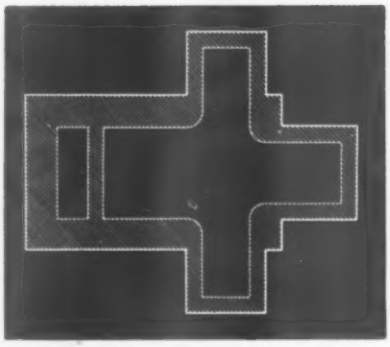
This newest of Stroman Furnaces is a combination of breakdown and holding furnaces. It's two in one ... and the most economic ever designed for aluminum melting. The MC Furnace is of the reverberatory type. It can be fired by either gas or oil or with combination burners, so that it is a simple matter to switch from oil to gas or vice-versa. Fuel costs are reduced to unheard of lows, combustion which is generally exhausted in ordinary furnace designs, is used in this furnace to pre-heat and melt the metal charge. No cold metal reaches the bath of molten aluminum, assuring fastest melting and uniform temperature of bath.

It is ideal for Die Casting, Permanent Mold and Sand Casting Plants. It is the zenith of speedy, efficient operation. Hot metal is ALWAYS available for dipping. Built to accommodate 500 to 4000 lbs. metal bath, the dip-out boxes are placed around the furnace so that three to six die casting or permanent mold stations may be easily operated with a single MC Furnace.

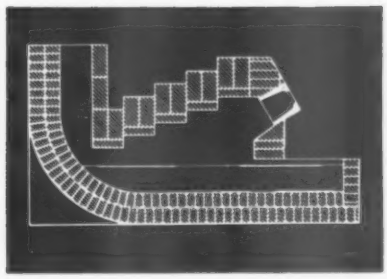
The Model MC brings "Good Housekeeping" to your plant. For returns, gates, risers, may be immemediately returned to the hopper with the ingot ... Creates Ideal Working Conditions, for furnace radiates very little heat ... Lowest Maintenance, no iron pots or crucibles to replace, no breakdowns ... Minimum formation of dross ... Finest quality castings, every time ... Furnace is delivered as complete unit, ready to melt. Complete Automatic Controls available if desired.

Compare floor space required for one Stroman Model MC to three breakdown and three holding furnaces to supply the same amount of molten metal. A tremendous saving in square feet, as well as man hours and metal saved in transfering from breakdown to holding.

Cut your aluminum melting costs to the bone ... Let Stroman Engineers show you how this great production furnace will fit into your plant and boost profits to new highs. Write today for full information and specification. Do it NOW.

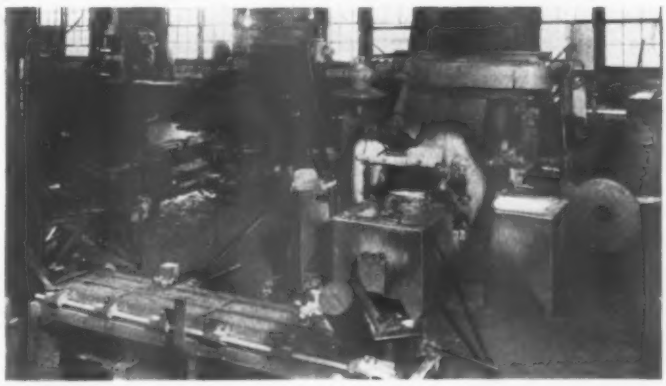


Horizontal View Showing 3 Dip-Out Boxes

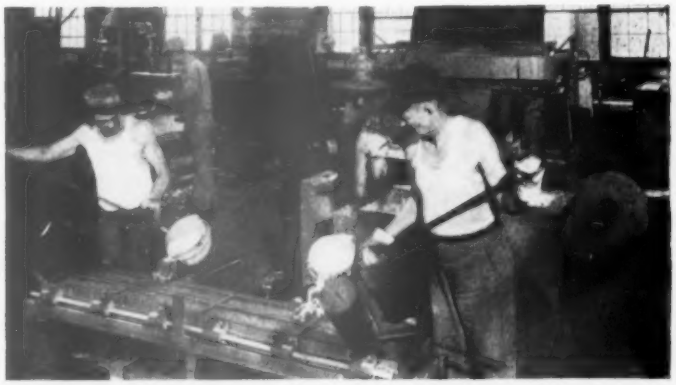


Vertical View Showing Combustion Chamber, Metal Bath and Charging Hopper.

Stroman Model MC Furnace illustrated has a 3000 lb. Metal Bath.



Small floor space still allows up to six men to work with ample elbow room.



STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

FAIRBANKS-MORSE cleans castings faster and more economically with HYDRO-BLAST

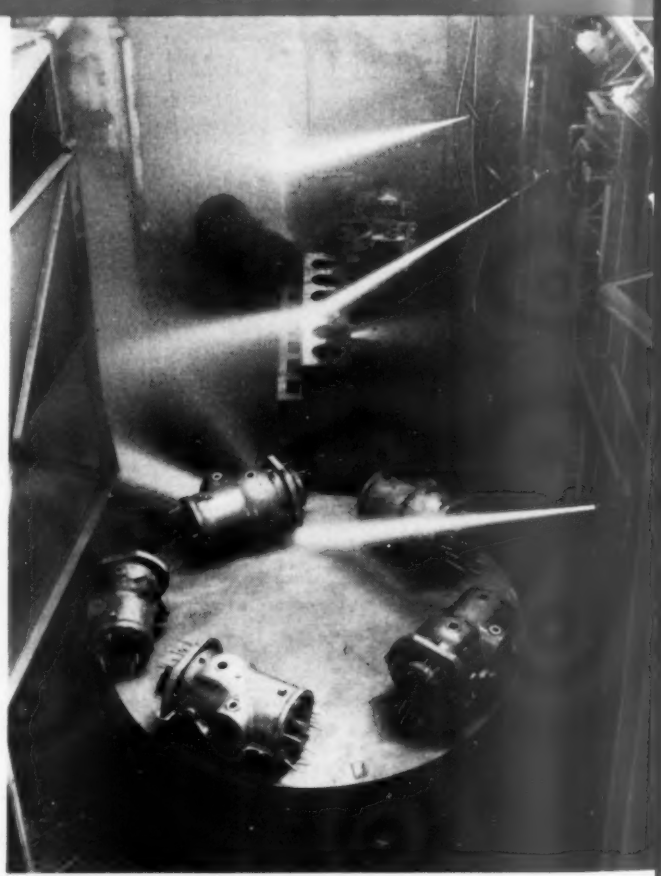
At the Beloit foundry of Fairbanks-Morse a Hydro-Blast unit designed to clean 75 tons of castings at one time is rapidly paying for itself through faster production and cleaning economies. Also, Fairbanks-Morse foundry executives express themselves as "greatly pleased" at reductions in machine shop costs and longer tool life resulting from cleaner castings.

Castings to be cleaned are placed on a central square platform and on two 12-foot turntables —one at either end of the enclosure. Each will accommodate 25 tons of castings.

Three guns of 75 gpm each, operated from control stations outside the enclosure, deliver the cleaning streams of water-and-sand at a pressure of 2000 psi. Each gun is moved laterally or vertically.

Hand-nozzles of 30 gpm capacity are also available for operation inside the enclosure.

Substantial benefits, as enjoyed by Fairbanks-Morse, can be yours through use of Hydro-Blast—the fast, clean, low-cost modern method.

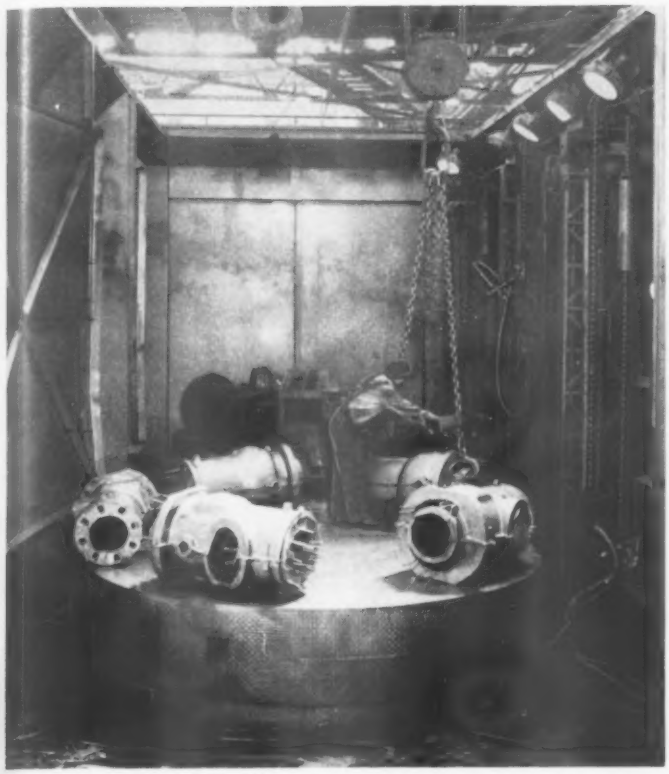


Three guns in operation, controlled from outside the enclosure. "Castings are so clean they look cadmium-plated" says a pleased executive.

You speed up the flow of castings through cleaning operations, with the potent plus-advantage of Hydro-Blast's *remarkable effectiveness in cleaning foundry air.*

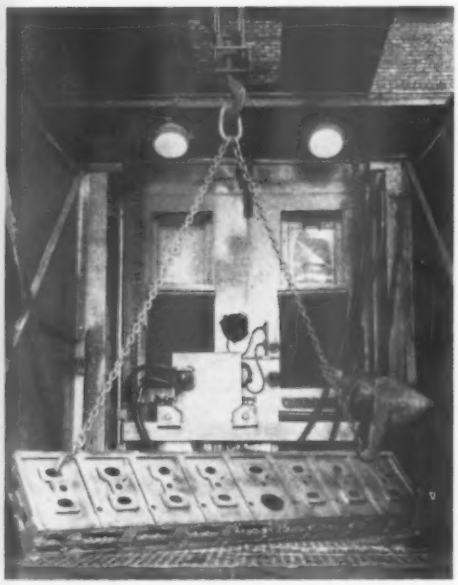
HYDRO-

2550 NORTH WESTERN AVE.



Removing a clean casting. Comparison with the worker indicates size of the room and turn-tables.

Two guns blasting large cylinder-block castings. Sand and water pass through floor gratings.



This center section can be partitioned off as a separate cleaning room.

The great 75-gallon guns are easily controlled from this outside panel.

There's a type of Hydro-Blast suited to your particular needs. It costs nothing to find out what it will save you —simply talk things over with Hydro-Blast engineers.

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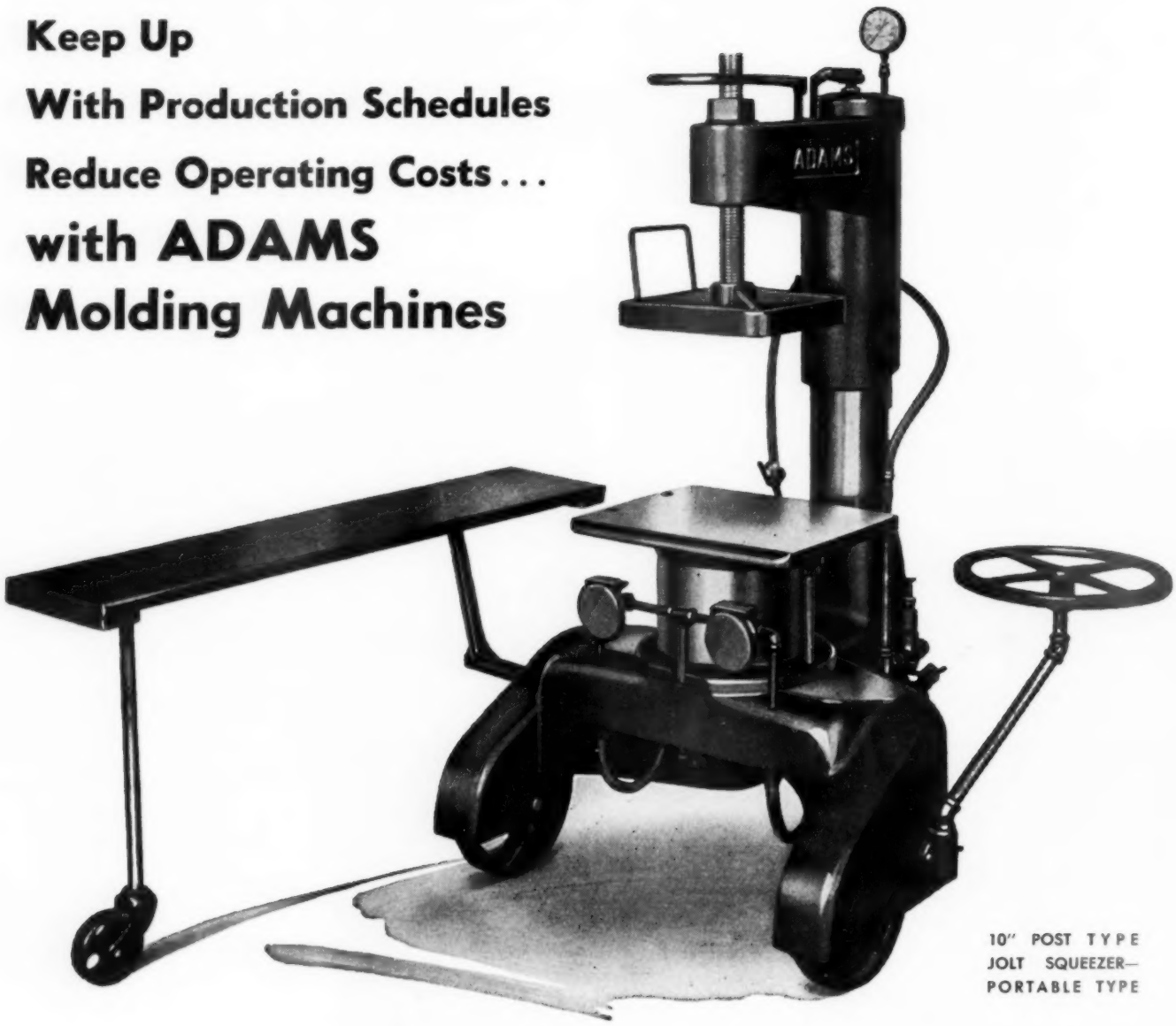

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All-out production—You'll get just that with Adams fast, accurate molding machines—and at lower costs! Their speed, stamina and power, plus simplified design for easy operation, help maintain steady, high output levels even with unskilled labor. Losses are limited by the close control of jolting and squeezing operations which assure accurate, uniform molds.

Here are some of the features that lower production costs—Minimum working parts, protected against sand and dust—convenient, accessible operating controls for quick handling—great flexibility—low maintenance costs. Adams molding machines give dependable, long term service. They stand up to the pressures of high production, maintaining their efficiency and accuracy throughout prolonged hard use.

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Side Rod Type and Post Type—Jolt Squeeze and Jolt-Squeeze-Pattern-Draw-Styles—Stationary and Portable-Hand Squeezers. Write today for full details in Catalog No. 705. THE ADAMS COMPANY, 700 Foster St., Dubuque, Iowa.

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ESTABLISHED 1883

MOLDING MACHINES and FLASK EQUIPMENT

DUBUQUE, IOWA, U.S.A.

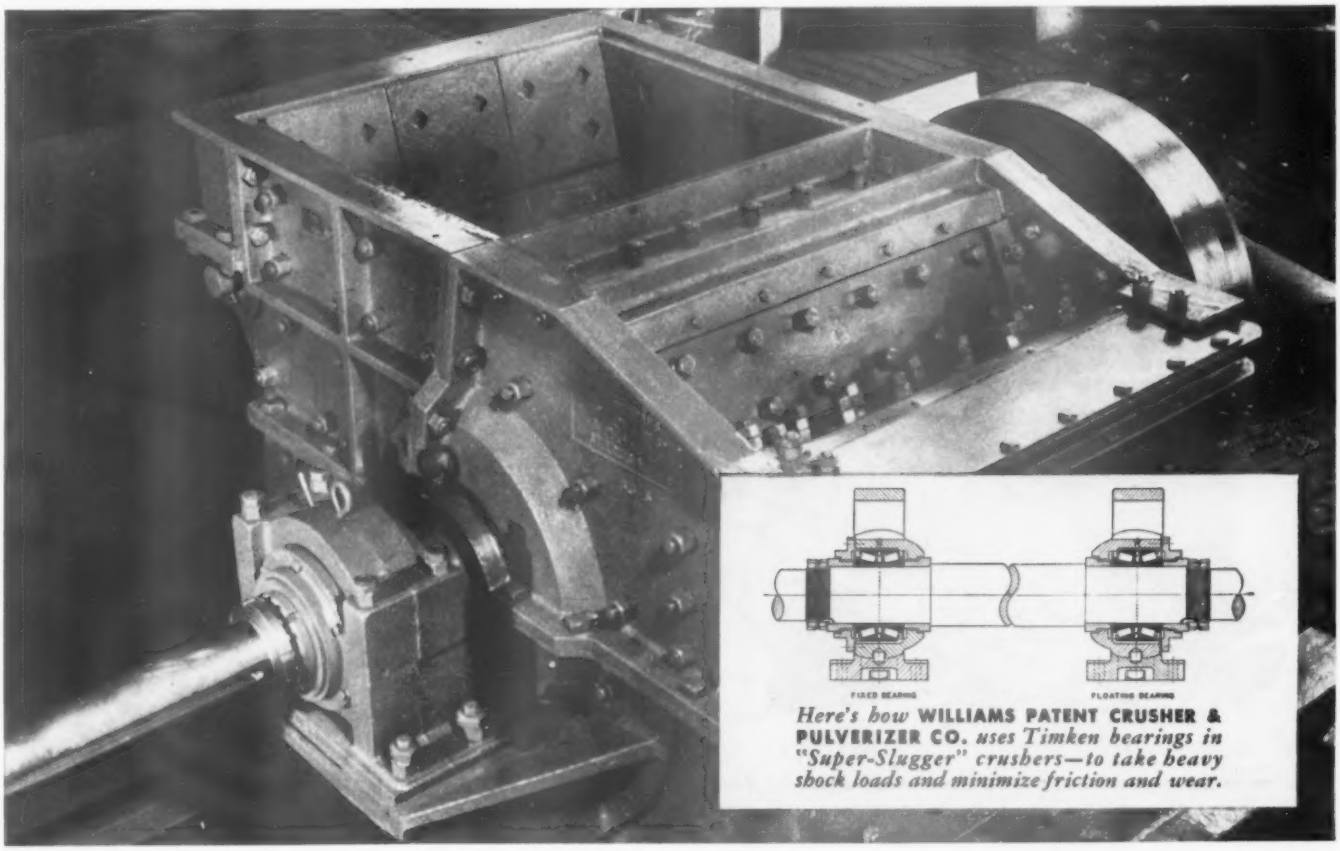
TIMKEN® bearings help "Super-Slugger" put more power in its punch

USED in the pillow blocks of this Williams "Super-Slugger" crusher, Timken® tapered roller bearings stand up under the severest punishment. With minimum power loss due to friction, the crusher has more power in its punch—crushes maximum yardage throughout a long and trouble-free life.

Due to the line contact between the rolls and races, Timken bearings have tremendous load-carrying capacity — give maximum support and rigidity to heavily stressed shafts. Their tapered roller construction takes both radial and thrust loads in any combination. True rolling motion and incredibly smooth surface finish of the rolls and races enables them to operate with minimum friction under the heaviest loads.

Timken bearings are made of the best steel ever developed for tapered roller bearings—Timken fine alloy steel. For fine bearing performance throughout the life of the machine, specify Timken bearings for all the equipment you make or use. Look for the trade-mark "Timken" on the bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address; "TIMROSCO".

This symbol on a product means its bearings are the best



Here's how **WILLIAMS PATENT CRUSHER & PULVERIZER CO.** *uses Timken bearings in "Super-Slugger" crushers—to take heavy shock loads and minimize friction and wear.*

FINISHED TO CLOSER TOLERANCES

Finishing to incredible smoothness accounts for much of the precise, smooth rolling performance of Timken bearings. This honing operation is typical of the amazingly accurate manufacturing methods at Timken.

The Timken Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS

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PATENTED* Malleabrasive CUTS

SHOT COSTS 35% TO 45%

for Cortland Forging Division of Brewer-Titchener Corporation

35% saved on shot costs alone! That's the result of Cortland's *first* 30-day test of *Malleabrasive* in their blast cleaning operations!

"It's too good to be true!" says the superintendent, 35% savings on shot is major league stuff. Put it back on test for another 30-days. Then we'll see!"

45% *savings on shot this time!* 70% saved on replacement parts . . . plus a finish 100% free of scale! That's the result of the *second* 30-day test . . . even greater, more conclusive proof of Malleabrasive's terrific cost-cutting performance!

You, Too, Can Cut Your Shot Costs

Malleabrasive can cut your blast cleaning costs as much as 50% because it differs from every type of shot and grit on the market today. It's more than "heat treated" or "annealed" . . . *Malleabrasive is guaranteed* to out-perform ordinary shot and grit, when comparative tests are properly run. *Get the facts.* Send for your free copy of recent Malleabrasive test results. THE GLOBE STEEL ABRASIVE Co., Mansfield, Ohio.

Packed in new orange striped 100 pound bags.

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U.S. Patent #2184926 other patents pending.)

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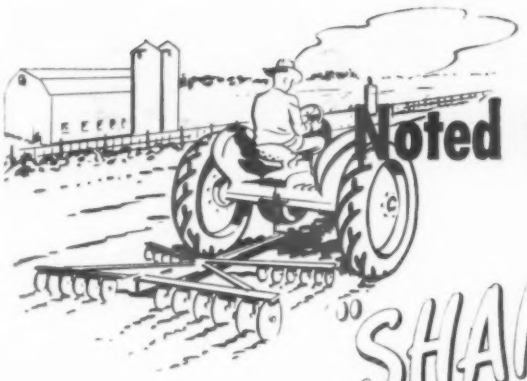
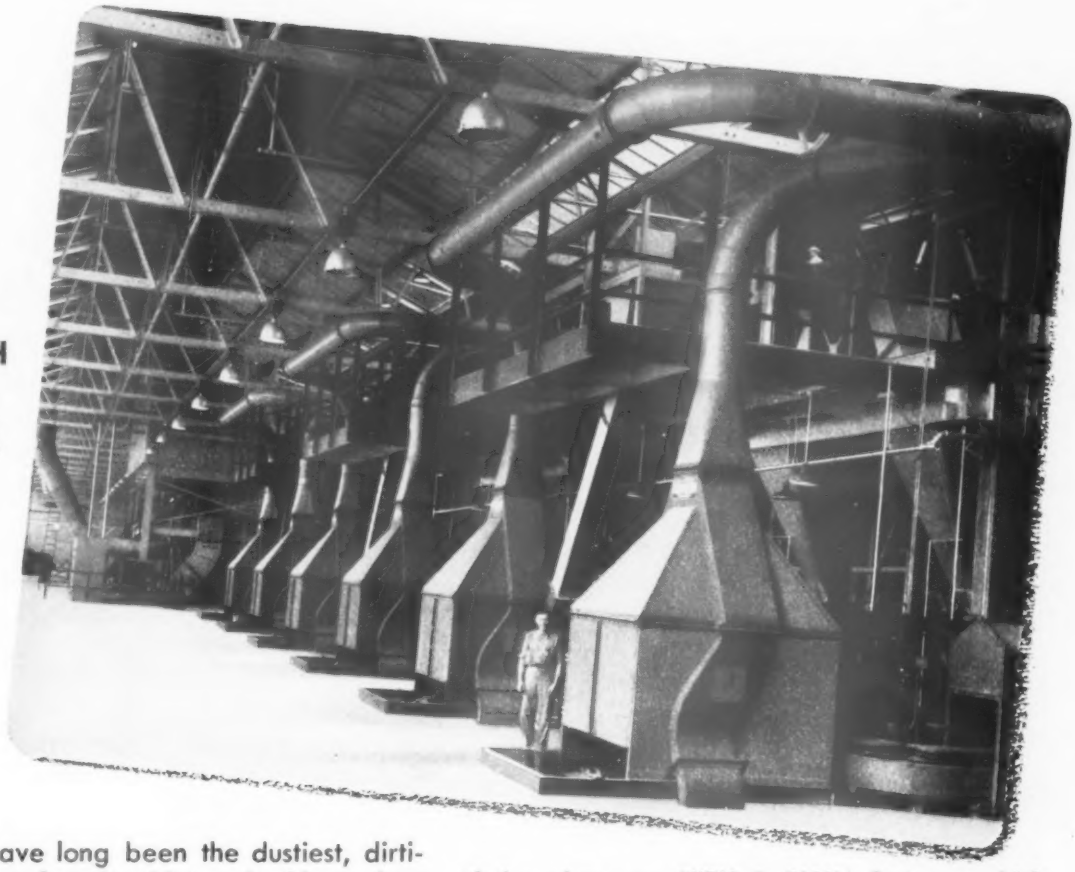
• MANUFACTURERS OF METAL ABRASIVES SINCE 1907 •



Noted farm equipment manufacturer "SHAKES" DUST PROBLEM!

"SHAKE-OUTS" EQUIPPED WITH KIRK & BLUM DUST CONTROL SYSTEM . . .



Shake-outs have long been the dustiest, dirtiest section of a foundry. Not so in this modern plant. Kirk & Blum installed these efficient "over-and-under" hoods which collect dust as it is released in the shake-out operation. In the photo above, six of the shake-out stations are seen. Piping is designed to meet AFA standards; note the cleanout doors and gasketed companion angle connections.

This installation is one of a number in the modern southern foundry of one of the world's largest farm implement makers. In other parts of the plant are KIRK & BLUM Systems which remove fumes, dust and chips from various operations.

From this and thousands of other installations in widely varying industries, KIRK & BLUM has gained great skill and knowledge, based on 40 years experience. This experience is at your service. Write for booklet, "Dust Collecting Systems in Metal Industries." The Kirk & Blum Mfg. Co., 2808 Spring Grove Ave., Cincinnati 25, Ohio.

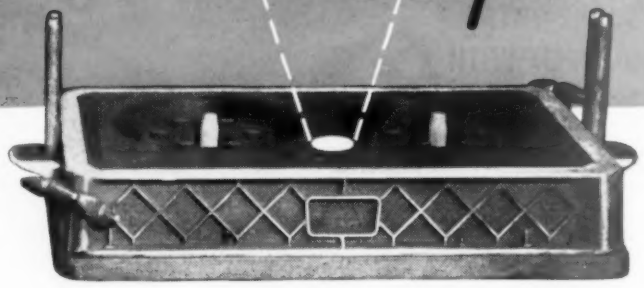
FOR CLEAN AIR . . . THE INVISIBLE TOOL **KIRK AND BLUM**
DUST CONTROL SYSTEMS

a *NEW* money saver

for the foundry . . . .

HARBISON-WALKER

Refractory STRAINER CORE *Shapes*



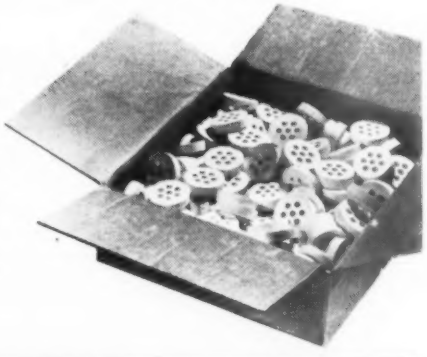
By reducing rejects caused by "slag" carried into the mold, Harbison-Walker refractory Strainer Core Shapes have proved their worth as a money-saving improvement in modern foundry practice. There is no spalling or erosion of these hard fired strainers, for they are made of high-strength, low thermal expansion ceramic materials. They serve to reduce losses of metal and to insure a higher production of acceptable castings.

- Made in seven sizes, having open areas the equivalent of stream diameters, from ⅝ to 1½ inches.
- Require no change in present molding practice. Packed for convenient handling.
- Now are used by some of the country's largest foundries in regular production work.

Refractory Strainers reduce the number rejected castings, by preventing the entrance of inclusions into the mold. They do not crack, spall or erode during pouring.

Convenient Carton Trays

Harbison-Walker Refractory Strainer Core Shapes are packed in carton trays for convenience and speedy handling on the molding floor. Available for prompt shipment of sizes most commonly used.



HARBISON-WALKER REFRACTORIES CO.
Pittsburgh 22, Pennsylvania

Please send me complete data on Refractory Strainer Core Shapes.

Name_____

Title_____

Company_____

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WORLD'S LARGEST PRODUCERS OF REFRACTORIES
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Workers get Clean Air and Clear Vision with ROTO-CLONE Dust Control

THEY don't "let the chips (and dust) fall where they may" in this foundry. Pictured here is a modern down-draft chipping booth which is served by an AAF Type D Roto-Clone.* Chips and dust are drawn off as fast as they are generated. Worker comfort is vastly improved and he has a clear view of the job at all times.

No matter what you grind or how you grind it, a Type D Roto-Clone will give you positive dust control. This compact, self-contained unit combines the functions of both exhauster and separator. All operations—drawing in the dust-laden air, separation of dust, delivery of collected material to storage hopper and expelling the clean air—are performed by one moving part.

You don't have to rearrange and disrupt your grinding operations to take advantage of Roto-Clone dust control. The Type D may be installed as a central type with main dust and branch connections or as an individual unit serving a single dust-producing operation. For complete information, call your local AAF representative or write direct to

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FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

**Roto-Clone is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator types.*

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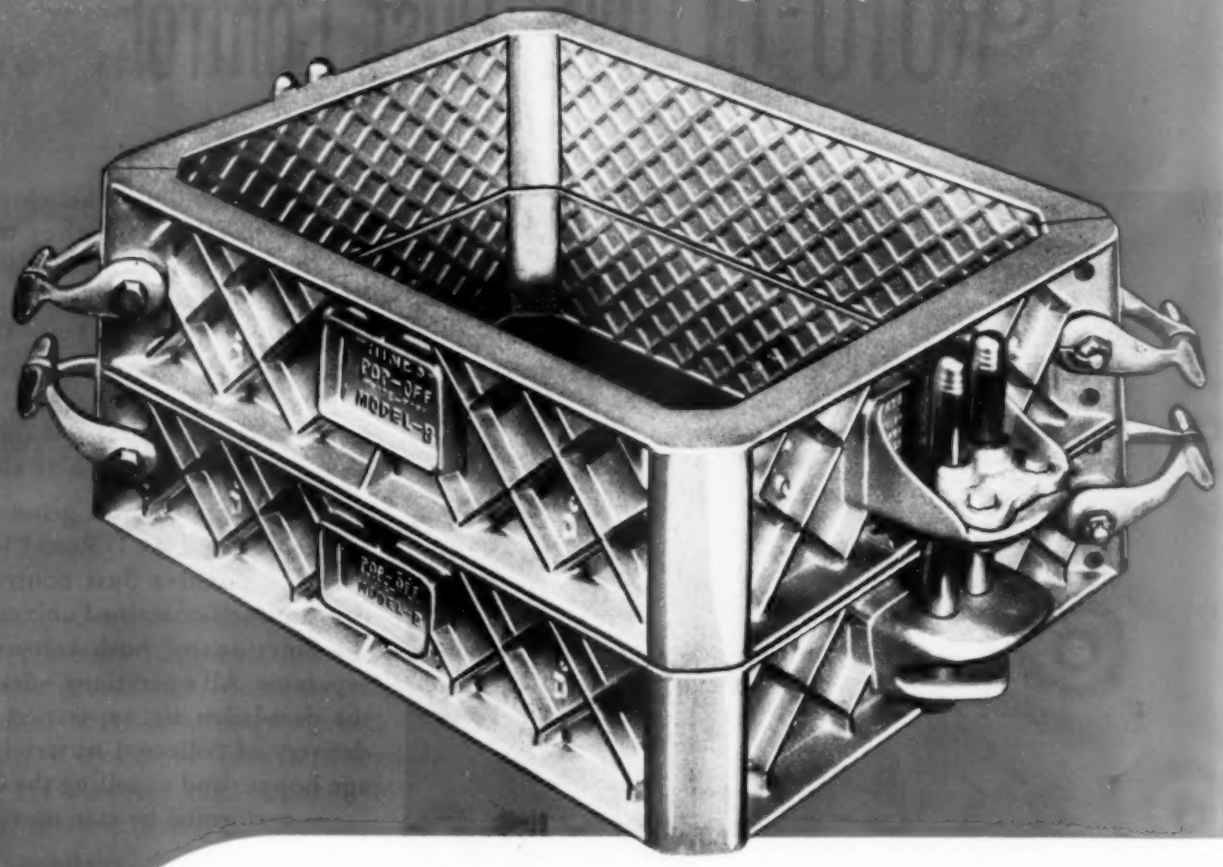
DUST CONTROL EQUIPMENT

Hines Model "B"

ALUMINUM POP-OFF FLASK

for high production on light squeezers



HINES
POP-OFF
(Trademark Reg. U. S. Pat. Off.)
FLASK

The LIGHTER WEIGHT M

This illustration of the Hines Model "B" Aluminum Pop-Off Flask is a good picture of a good product—but many of its important points can't be *seen.* Some of these points are LIGHT WEIGHT, EXTREME DURABILITY, LOW PRICE, UTILITY and the fact that it will ELIMINATE SHIFTS. Hines Flasks are designed to "make the tough jobs easy"; they set a pattern for economical foundry operation.

FOR BEST RESULTS, USE HINES JACKET . .

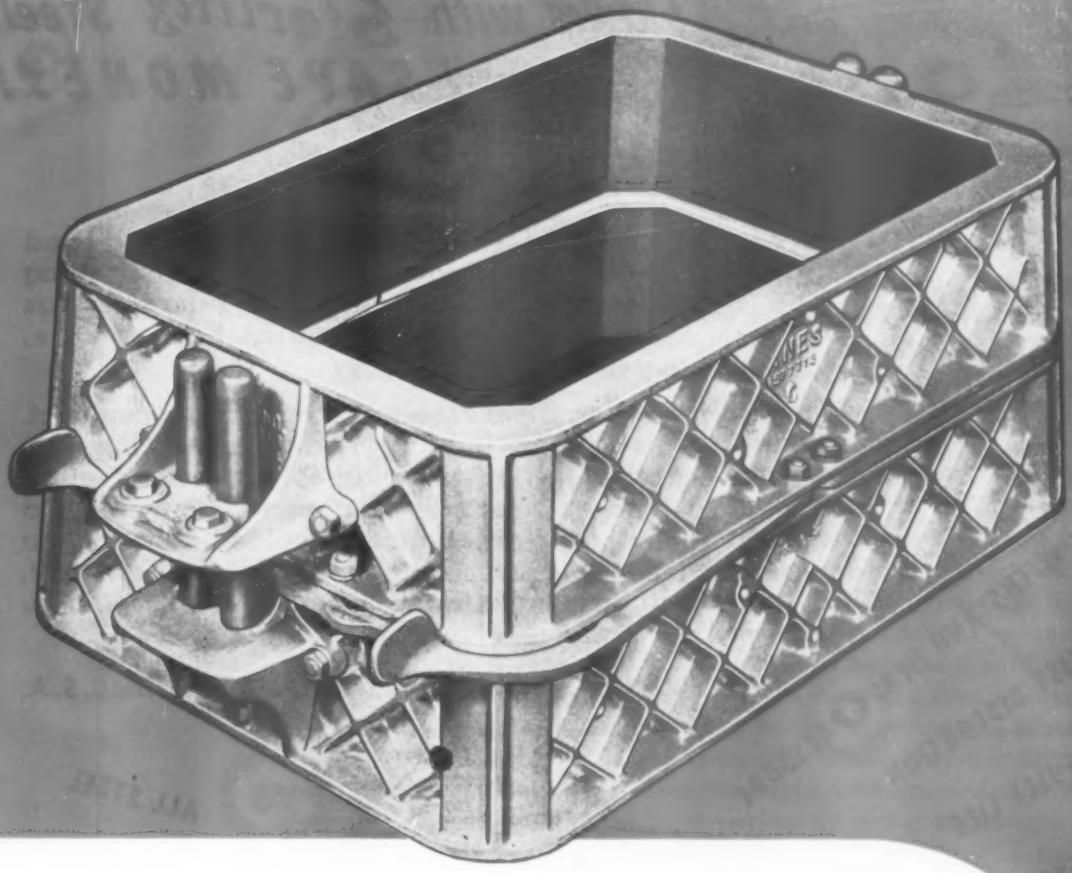
THE HINES F

3431 WEST 140th ST.

Hines Model "A"

ALUMINUM SLIP FLASK

for light squeezers . . . pattern casting . . . trade schools



METALLIC FLASKS

The Hines Model "A" Aluminum Slip Flask is particularly recommended for light squeezer work, pattern casting and for trade schools. It is much lighter in weight than the ordinary flask, making the molder's work that much easier. It costs less, outlasts other flasks, and reflects credit on an organization that has been exclusively a builder of flasks and jackets over a period of twenty-five years.

All Hines Flasks are fully protected by U. S. and Foreign Patents

. . THEY ALWAYS FIT THE MOLD SNUGLY

FLASK CO.

CLEVELAND 11, OHIO

Why POUR PROFITS into YOUR FLASKS?

Replace Old-Fashioned Wooden Flasks with Sterling Steel Flasks and SAVE MONEY!

Yes—you actually lose money by using old-fashioned wooden flasks with the constant possibility of burning up and necessary replacements. Irregular partings cause serious and costly runouts. Furthermore, lumber is very expensive today.

Modern Sterling Steel Flasks are much more compact, save up to 15% of foundry floor space. They are more accurate . . . custom-built for the really tough foundry jobs . . . soundly engineered to withstand tremendous pressures. Solid, all-welded construction assures many years of dependable service at low cost. That's why Sterlings are the preferred flasks in more than 4500 American Foundries.

STERLING WHEELBARROW CO., Milwaukee 14, Wis., U. S. A.

WITHSTAND HEAVY PRESSURE
RESIST DISTORTION
LONG SERVICE LIFE
ACCURATE
CUSTOM BUILT
NO SPLINTERS
EASY HANDLING
FULL WIDTH BEARING
REINFORCING RIBS

ALL STEEL
COMPACT
ALL WELDED
LIGHT WEIGHT
SQUARE FLANGES
RUGGED
SOUNDLY ENGINEERED

A 5713-1P-C

Research Pays Off For Steel Founders

VALUE of research to the foundry industry as a means of improving castings and reducing cost of production is well illustrated in the comprehensive program being carried on by the Steel Founders' Society of America. The work that has been done and the projects now under way provide steel foundrymen with data of value in meeting present day competition.

Research of the society is a carefully planned program which has three definite purposes. Each study is undertaken with the idea that it will improve the quality of steel castings, reduce production costs, or increase the fundamental information on cast steels so that the customer, the engineer, and the student may be more familiar with the advantages of steel castings as engineering materials. Proposed projects, which may be suggested by any member of the society, are given careful study by the Technical Research Committee. A brief, giving procedures and scope of the study, is prepared by the Technical and Research Director of the society before the project is presented to the Research Fund Committee for action on an appropriation to finance the particular job. Work on an individual study may be carried on by a research organization, by one or more foundries or through a combination of these groups.

To date six research reports and three continuing projects have been concerned with improvement in quality of products; nine reports and five continuing projects have provided data to reduce production costs, and eleven reports have expanded the knowledge of cast steel. Studies have dealt with materials used in production, such as core oils and binders, mold and core washes, sands, and pipe eliminators. A number have been devoted to production problems, including effect of gases in steel, riser efficiency, feeding, control of solidification and heat treatment. Others have been concerned with properties, such as impact, austenite grain size, ductility improvement by aging treatments, microstructure and mechanical properties, weldability, reproducibility of tensile test results, and dendritic and as-cast structures. Projects 6 and 11 on determination of critical dimensions for necked-down risers probably have received greatest attention and have provided information which has reduced cleaning room costs and in many cases, where the cleaning room has been the production bottleneck, has permitted a marked increase in output.

Up to the present, the society has spent approximately $200,000 on this research work. Conservative estimates indicate a potential saving to the steel foundry industry of between $2 million and $8 million, depending on the extent to which the research reports are applied by the individual foundries to production and sales problems. This surely is an exceptional return for the money invested.

The Steel Founders' Society of America and those in charge of this work are to be congratulated on doing an outstanding job in the field of research.

Frank G. Steinebach
Editor

Statue o

Appropriate to the month is this description of the making of the large bronze figure of George Washington. The statue will be unveiled by the George Washington Masonic National Memorial Association at Alexandria, Va., Feb. 22.

By PAT DWYER
Engineering Editor
THE FOUNDRY

CASTING THE LARGE e of Washington

HERO worship probably is one of the oldest and most universal attributes of the human race. It is not the monopoly of any land or of any people. Names of outstanding men and women are preserved and perpetuated in legend and tradition, in song and story. Mementos of various kinds are established and erected in their honor and to keep their memories alive and green. To Americans, native born or naturalized, George Washington—"first in war, first in peace and first in the hearts of his countrymen"—occupies a special and lofty niche in the hall of fame.

A scholar, a student, a wealthy and aristocratic landed proprietor, he was a prominent member of the courageous group who boldly pledged their lives, their fortunes and their sacred honor to a cause they considered just and right.

The words of Bancroft the historian on another occasion, also might apply to Washington: "So long as grass grows and water runs, so long as the great rivers of America go foaming and swirling down to the sea, so long as the English tongue shall be the language of freedom in the hills and valleys, the mountains and the prairies, the name of Washington shall be admired and honored." Incidentally, the reproduction of his features on the lowly one-dollar bill, helps to keep him in mind.

The latest memento, a huge bronze figure, made under a commission from the George Washington Masonic National Memorial Association, was designed by Bryant Baker, noted New York sculptor, and cast at the plant of the Gorham Co., Providence, R. I. It was shipped in three sections to the association building, Alexandria, Va., where it will be assembled and made ready for unveiling Feb. 22, 1950, before an international Masonic gathering.

The statue shows Washington, first master of the Alexandria-Washington Lodge 22, as he arose to address the first meeting. He is wearing his black velvet dress coat, reserved for portrait sitting and state occasions, also a Masonic apron adorned with five stars, seven cherub heads surrounding a triangle

Fig. 1—Finished clay model of the Washingon statue, 17 ft 3 in. high, may be contrasted with the sculptor, Bryant Baker, standing on the ladder

Fig. 2—A light trapeze on top of the cope supports a block and a light line leading to the floor. When the basin is filled with metal an attendant pulls the line and lifts the plug from the sprue opening

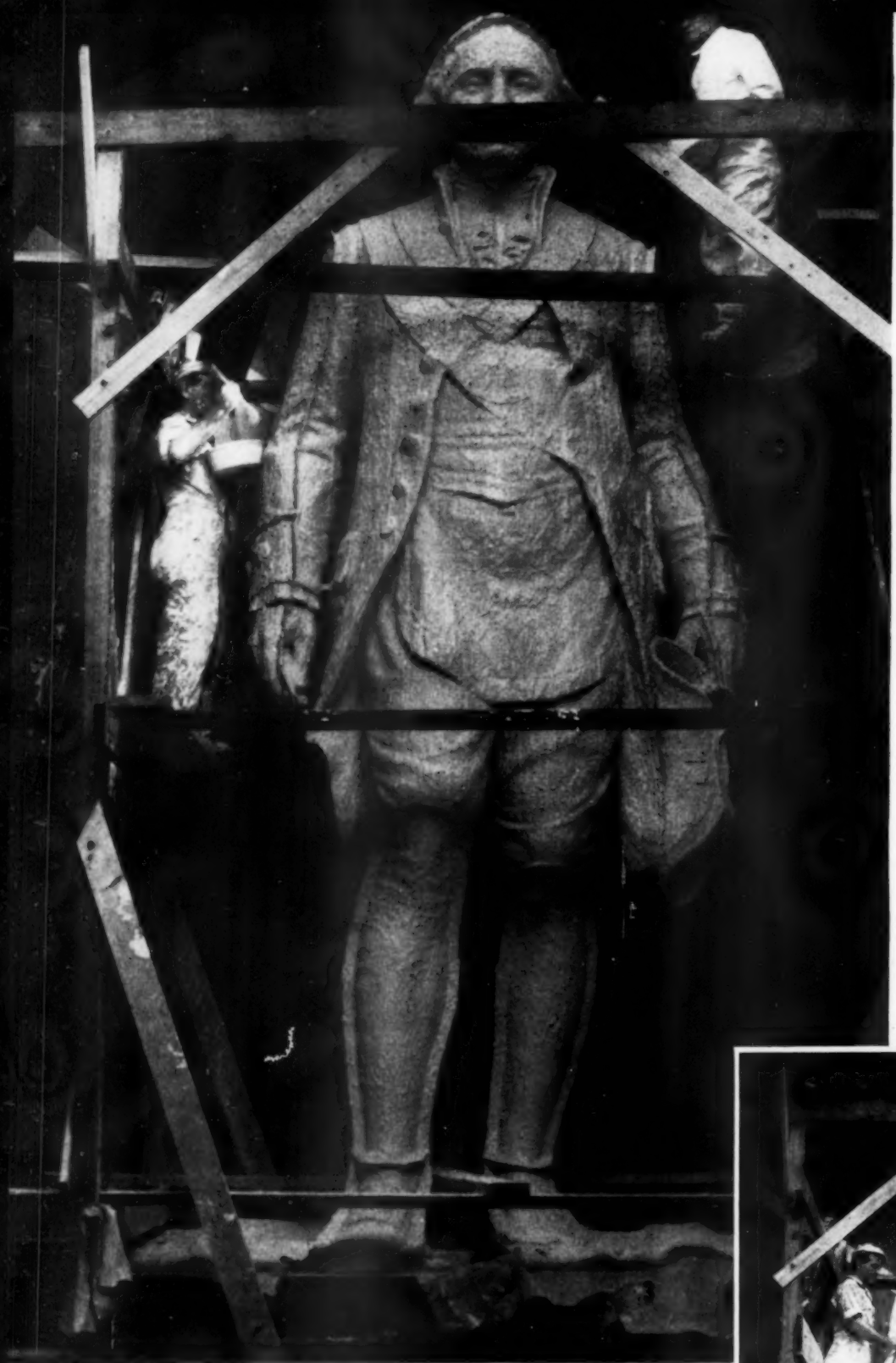


Fig. 3 — Mr. Contini and son Caesar, fifth generation of plaster molders, are shown applying the first coat of blue-tinted plaster to the finished clay model

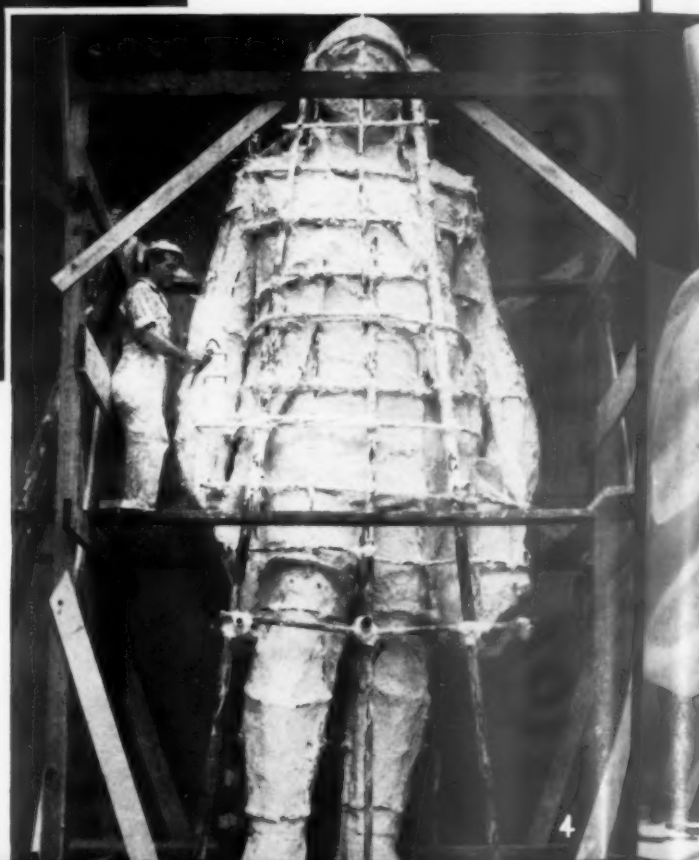
Fig. 4—Finished plaster mold with iron reinforcement carries the weight on strong steel girders at the base. The plaster pattern for the foundry is formed inside the mold

★ Statue of

Fig. 5—This historic chair and military cape used by Washington when first Master of the Alexandria-Washington Lodge 22 was modeled direct in plaster instead of clay

Fig. 6 — One section of the plaster pattern, about 9 ft high, shows the Roman or locking joint at the top. The block under the foot will fit into a corresponding socket in the base

Fig. 7—The finished plaster cast was taken apart before shipment to the foundry. The small trap door at the back allowed the molder to work inside the mold and unscrew the nuts



tue of Washington

and crossed American and French flags. The huge size of the statue is indicated in Fig. 1, which shows the sculptor Bryant Baker at one side of the completed clay model 17 ft, 3 in. high. The completed bronze figure weighed 8 tons.

Large bronze statuary figures, either single or forming part of a group, are made according to either one of two methods. In one a thickness of wax is employed to represent the pattern. It is enclosed between the inner and outer walls of the mold during the construction period and is melted out after the mold is completed and while it is going through the drying stage. Metal is poured into the cavity left by the wax and naturally it duplicates every feature, including the thickness. This is known as the *cire perdu,* or lost wax process.

In the second method a plaster pattern is prepared. The mold is made in sand in an iron or steel flask. With the exception of several features connected with drawbacks and the cope, the basic method pursued in making the mold does not differ from that practiced in the ordinary jobbing foundry in the production of castings of the same general size and shape. A three-part flask is employed. It is rolled over. The cope is lifted off. The pattern is removed. The core is set. The flask is closed and the metal is poured into the mold.

However, a considerable amount of preliminary work is required before the pattern is delivered to the foundry. Up to a certain point this preliminary work is the same whether the casting is to be made according to one or the other of two methods. The following description applies to the second method.

Having decided on a definite design for the proposed casting, the sculptor prepares a perspective sketch to illustrate what he has in mind. With the sketch for a guide, he fashions a clay model usually about 12 in. high. Every feature of the finished figure is worked out in accurate detail. The clay model is set up on a suitable stand where the sculptor refers to it constantly for verification in constructing a full size duplicate, also in clay. The clay is built around a wood or steel skeleton, made of pipes or bars, erected on the inside. This is known as an armature.

A plaster casing several inches thick is built up around the clay figure to form a mold for the plaster pattern which goes to the foundry. This casing corresponds to the loam wall which a molder builds on the outside of a pattern in ordinary foundry practice. A thin coating of plaster, tinted blue for a purpose to be explained later, is applied to the clay figure. This is followed by thicker plaster poured into suitable rough wood forms built up around the figure in successive tiers until the figure is completely enclosed.

Under certain conditions the wood forms are not used. The soft plaster in gobs is thrown on by hand. In either method the wall is parted by thin metal strips set at convenient points to facilitate removal of the clay and reinforcing structure, and later the application of the plaster to form the foundry pattern.

The plaster mold is taken apart. The clay is removed. After the inside surface has been cleaned

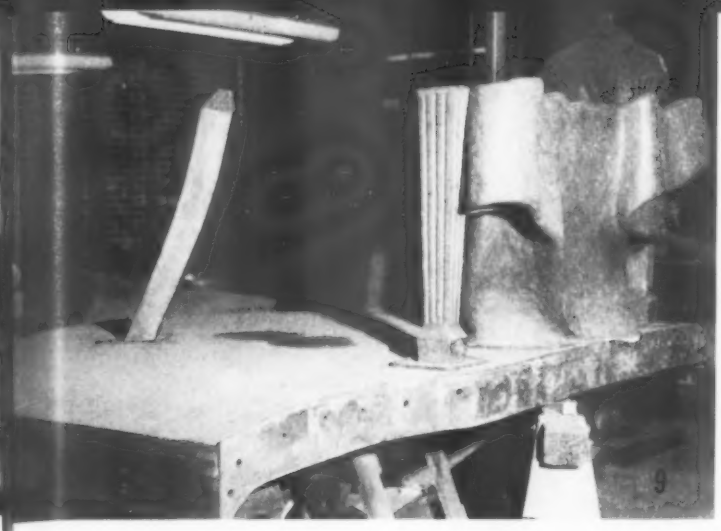
★ Statue of Washington

Fig. 8—Showing part of the drag mold for the body of the chair. This was the largest mold in the group and when fully assembled weighed approximately 60 tons

Fig. 9—Showing half of the chair base casting, with the legs and part of the drapery

Fig. 10—The sand core is lifted out of the mold and a thickness of sand corresponding to the desired thickness of metal is shaved from the surface of the core

Fig. 11—One of the skilled craftsmen forms the small drawback core over the eye of the plaster figure lying in the drag



thoroughly, the mold is reassembled, one, two or more sections at a time for the convenience of the man applying the plaster for the pattern. The interior face of the plaster mold carefully is painted with a solution of green soap containing a little tallow. This material fills the pores of the plaster and prevents any suction. The mold face then is covered with plaster to form the pattern which goes to the foundry. The soap film prevents the plaster from sticking to the mold.

After the first coating of thin, liquid plaster, the remainder of the plaster is applied by throwing it against the face of the mold in handfuls, approximately in the same manner that a molder applies loam to the face of the brick work in a loam mold. It is apparent that if the plaster mold is assembled at first in its entirety, an extremely difficult, if not impossible problem would be presented in the application of the plaster. With a mold in as many sections as may be considered necessary, the plaster readily is applied to one part at a time until the entire face of the mold is covered with approximately 1-in. thickness of plaster.

Usually, since only one casting is required, and since the pattern itself never will be used again, except possibly for exhibition or demonstration, no particular care is exercised in the removal of the plaster mold from the outside. It may be noted in passing that up to this point the two methods referred to for making the pattern are fairly parallel. At this stage of the process, they separate. If necessary, the plaster mold employed in the lost wax process carefully may be built up in jointed sections that may be removed and reassembled many times for the production of as many wax patterns as may be required, as in ordinary practice.

In the method under consideration, the method used in the present instance, the rough outside plaster mold is knocked away with a hammer and chisel. When the expert operator notes the blue tint on the plaster, he knows he has arrived close to the face of the plaster pattern. Thereafter he proceeds cautiously. All minor ridges and imperfections on the surface are removed under the supervision of the sculptor. After he is satisfied that the pattern conforms to his conception, he turns it over to the foundry. Large figures are divided into several sections for convenience in molding, and those later are joined together.

The finished mold with outside reinforcing frame work extending upward from the steel girder base is shown in Fig. 4. Seams or openings on the arms have been uncovered by cutting through the plaster wall to reveal the thin brass strips. A thin chisel carefully inserted along the joint separates adjoining parts.

Method of gating statuary and related forms of ornamental bronze castings through a multitude of small gates has not changed since first practiced by the Greek and Roman skilled craftsmen. In this connection also it is interesting to note that the so-called Roman joint, developed by ancient artificers, still is in use where various parts of a statue are cast separately and afterward united to precent a clean, smooth unbroken surface.

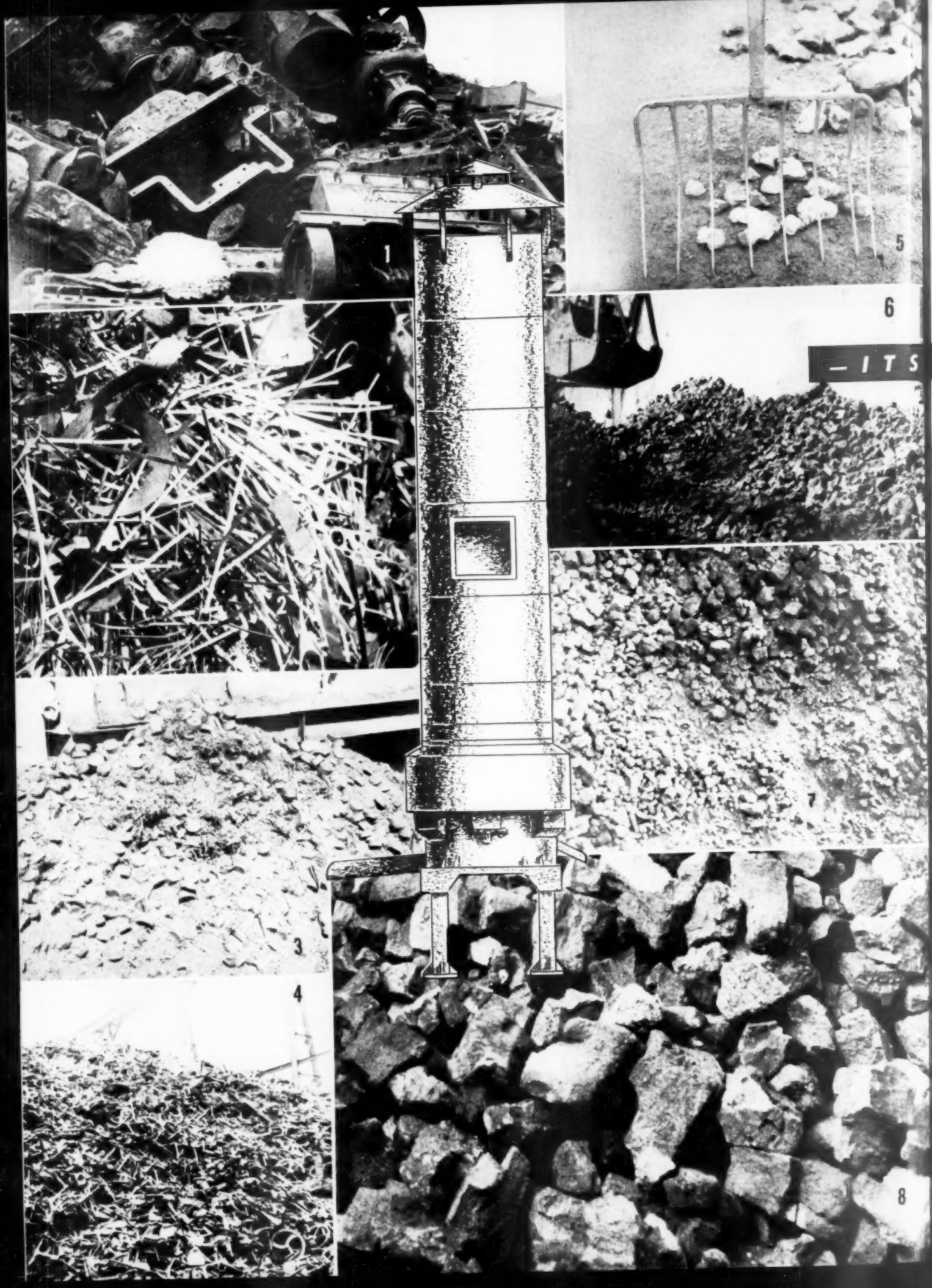
Adjoining ridges on the male and female joint are hammered down flat so that the metal flows into intimate contact. The resulting joint then is filed and scraped until no joint is visible. In the early days and up to comparatively recent years, rivets or bolts held the joint parts in firm and intimate contact. In recent years the same purpose is achieved with the welding flame. As with other major and minor tricks of the trade, the basic principle of the Roman joint never has been changed since it first was hit upon by an ingenious metal statue maker.

To facilitate work in the foundry, the George Washington plaster pattern was divided into several sections—head, torso, right and left arm, and right and left leg. The chair and base also were prepared separately.

Various steps in the preparation of the clay model and the plaster patterns are shown in the accompanying illustrations. Fig. 5 shows the plaster model of the historic Washington chair and military cape. This was the chair in which Washington presided as first master of the Alexandria-Washington Lodge 22, Alexandria, Va. It is claimed the foundry work in production of the chair involved greater difficulties than the production of the statue. The French sand mold of the chair section in one piece, minus the back legs and the upper legs part of the back, weighed approximately 60 tons when assembled and ready to receive the metal. The chair was modeled directly in plaster instead of in clay. The illustration shows Mr. Baker at work on the job.

Because of the wide variety in design which characterizes the patterns in this line of the foundry business, also on account of the fact that the same casting seldom or never is duplicated, it has been found advisable to provide knock down flasks that may be assembled in many combinations. In some instances the sides and ends are lengths of steel I-beams bolted at the four corners. The lower edge or flange of the I-beam serves as a sand strip. Chuck bars bolted to the sides and long rods extending from side to side, and with the ends tightly wedged in square holes in the I-beams, reinforce the sand and hold it in position. Channel beams bolted flat on top of the cope prevent the sand from rising when the mold is filled with metal.

In the usual routine the (*Please turn to page* 231)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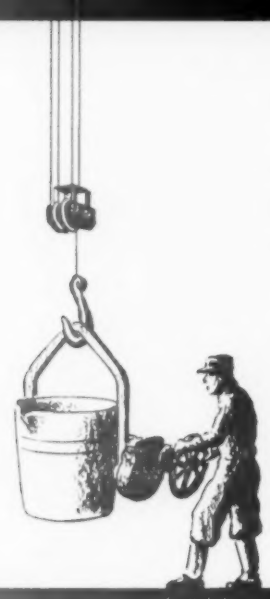
THE Cupola



RAW MATERIALS AND OPERATION

In this first of two articles the author offers recommendations concerning cupola charging equipment, metal charges and fuel. The paper was presented before the New England Regional Foundry Conference held at Massachusetts Institute of Technology, Oct. 7-8

By B. P. MULCAHY
President
Fuel Research Laboratory Inc.
Indianapolis

Undesirable metal for the cupola, when used in excessive quantities, includes sections too thick (Fig. 1), too thin (Fig. 2), poorly bonded briquettes (Fig. 3) and fine sprue when packed densely (Fig. 4)

An inexpensive coke screen is a regular fork (Fig. 5) with every other tine removed. Unloading coke by clamshell bucket (Fig. 6) is not recommended; coke's friable nature results in easy breakage (Fig. 7). All coke should be rescreened (Fig. 8) before using

THE physical simplicity of the cupola is largely responsible for most of the metallurgical difficulties encountered in the production of cast iron. This same simplicity, however, is the reason for its longevity in the face of highly advanced technical competition. Under most conditions today the cupola still remains the most efficient melting furnace we have for producing gray iron.

The above statements, while appearing contrary, are easily reconciled. We are well aware of the simplicity of the equipment and the mechanics of operation which immediately recommends the process to industry. The low initial and maintenance cost, its high productivity and, above all, the inherent correctness of counter-current flow and intimate contact of materials all contribute to its economic and thermal success.

The mechanical simplicity is the snare which leads most of us to the conclusion that the chemistry of the process follows the same simple direct action, and this thinking leads us into the confusion existing in many phases of operating the cupola. The complexity and difficulties arise because of the extreme variations in quantity and quality of the five main constituents—equipment, raw metal, fuel, air and mode of operation—and yet all can be directionally controlled if we will consider them individually and determine what effect each factor has and the necessary limitations of each factor we must impose.

It is the purpose of this discussion to examine the problems in this manner and, if possible, to discover certain fundamental laws which influence the process regardless of the type of iron produced. It is presupposed that any attempt to establish a reliable operation will automatically include proper equipment and procedure for weighing or measuring the quantities of all materials used in the process.

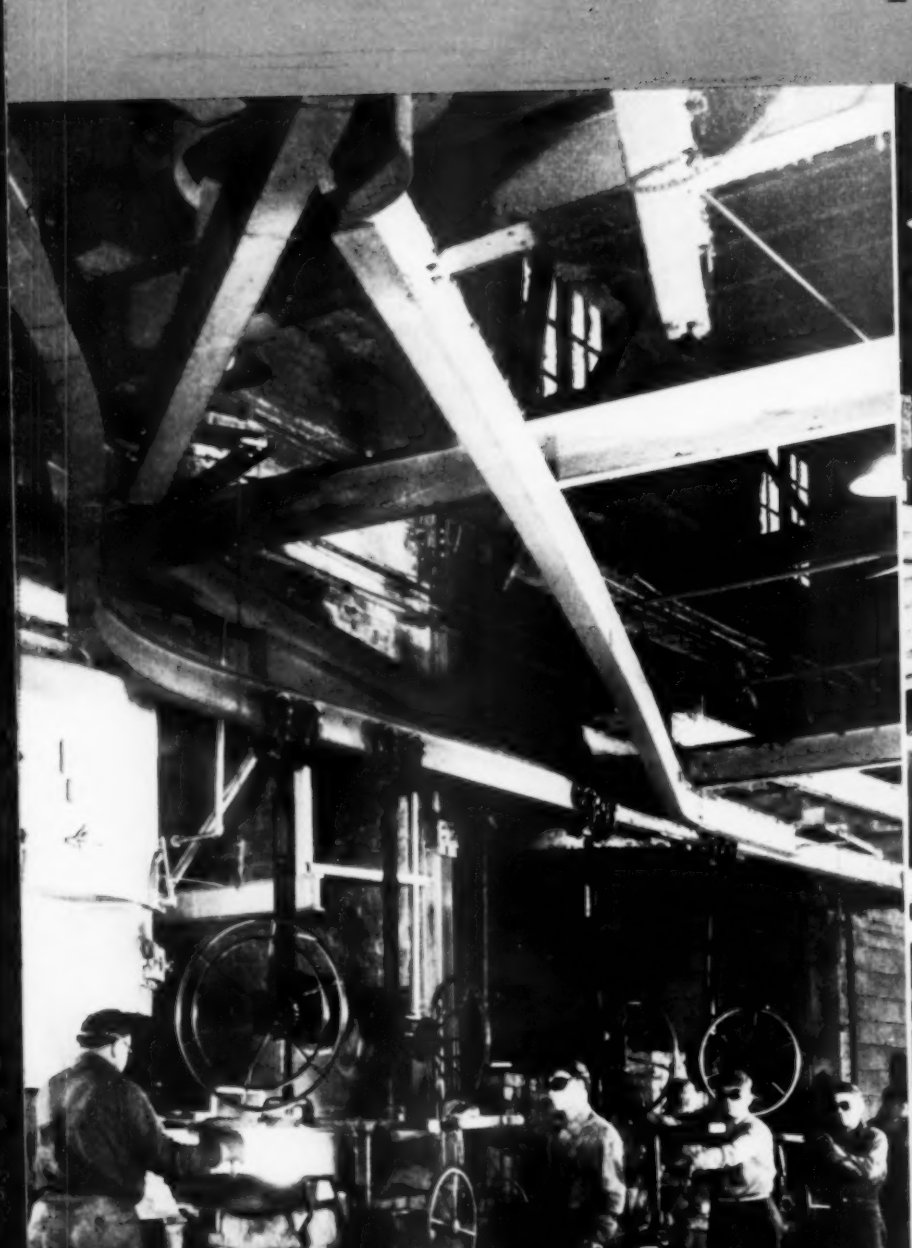
Before considering any of the intimate factors it seems well to review the process itself in generalities because of imposed conditions limiting the scope of operation.

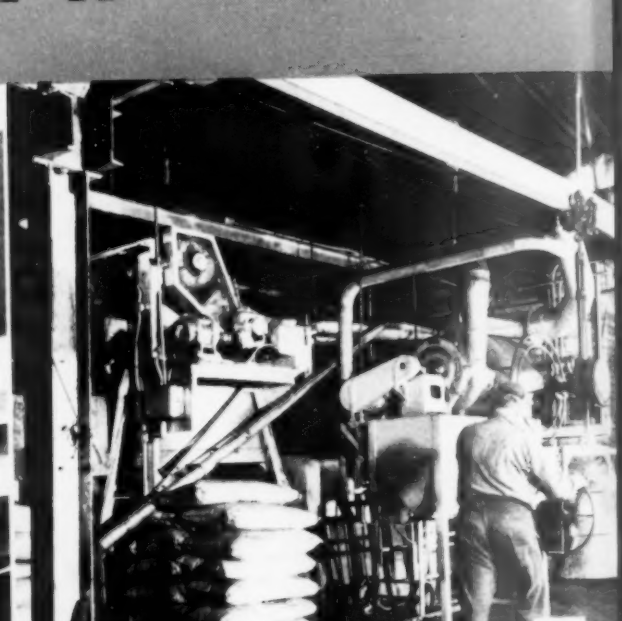
In brief, the equipment consists of the cupola, a refractory-lined shaft open at the top and equipped with ports somewhere near the bottom for the introduction of the air from a blower. Alternate charges of metal and coke are placed on top of the burning coke bed to fill the cupola. Air is turned on and the heat generated melts the iron, which is continuously drawn off through a hole for this purpose. This operation continues for the amount of iron desired.

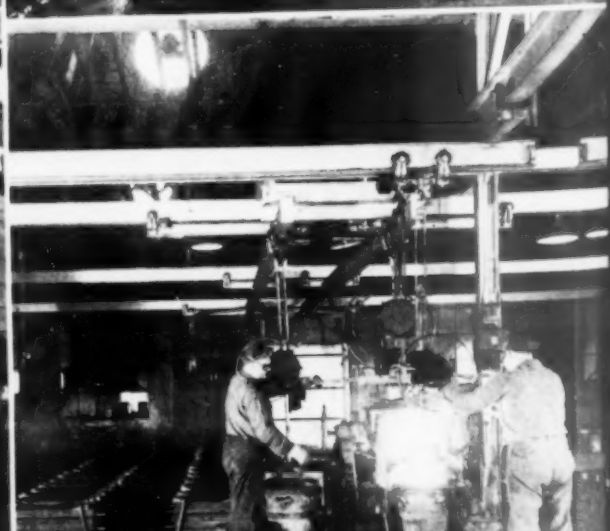
In this process, therefore, we have the iron always descending, first in the solid state and then gradually converted into a liquid. The heat meanwhile, generated at the bottom of the shaft by the combustion of the coke with the air, is driven constantly upward and out. Always, therefore, we have the two in counter-current flow and, of (*Please turn to page* 226)

Handling Materials

IN METAL P

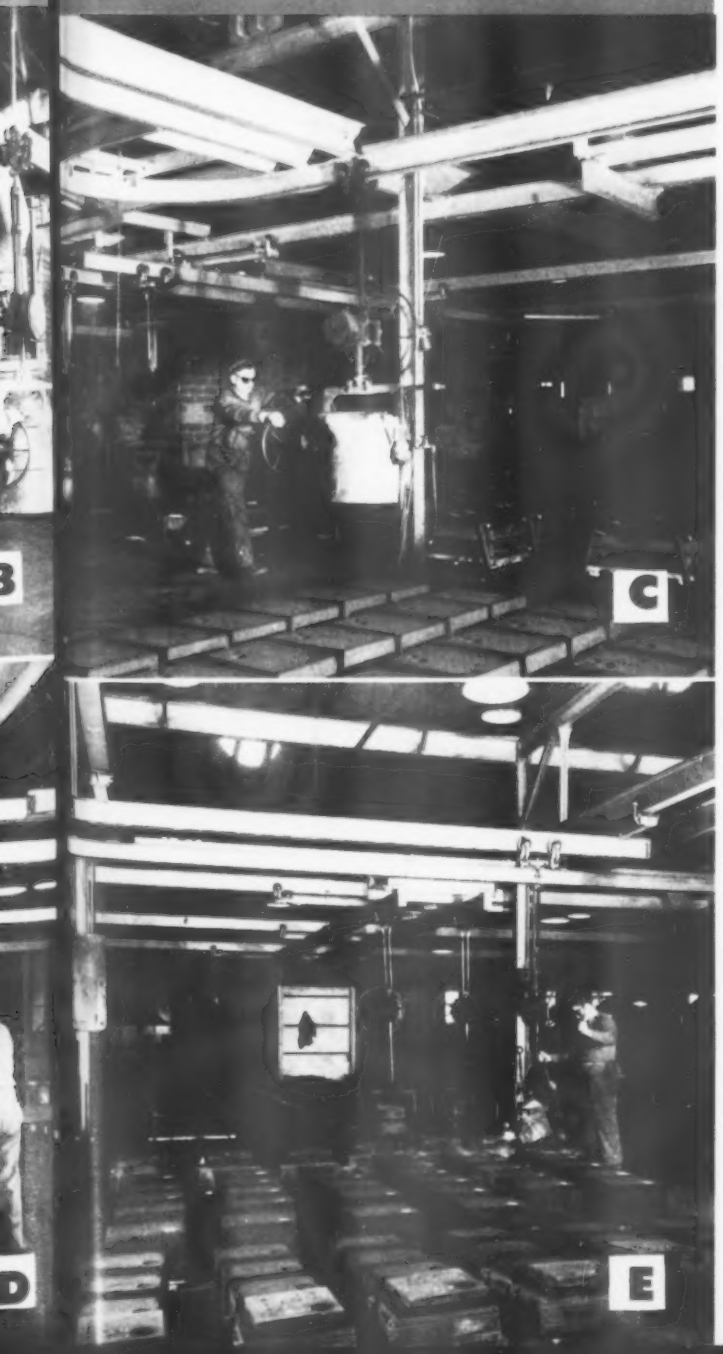






Materials handling equipment used in metal pouring is discussed in this fifth of a series of articles dealing with movement of materials in foundry operations. Previous articles dealt with equipment for handling materials in the foundry yard, in furnace charging, in the molding and coreroom departments

L POURING



By ROBERT H. HERRMANN
Associate Editor
THE FOUNDRY

MOLTEN metal is an extremely "perishable" product. Consequently proper handling between furnace and mold is an important consideration in the production of sound, marketable castings. Delay in its movement, once it leaves the furnace, can make the metal vulnerable to loss of heat, loss of properties carefully built up through properly calculated additions, and absorption of gases painstakingly removed in the furnace.

Speed is not the only consideration in molten metal movement; synchronization or proper timing also is important. Rushing the metal away from the furnace is of little value if the conveyor or other transportation system for carrying ladles is poorly planned or of inadequate capacity, resulting in traffic jams or bottlenecking. A conveyor system must be planned to avoid a clash between movement of filled ladles, returning empty ladles, and other traffic in the plant. If the metal is being carried by ladle truck, and the truck is delayed through poor scheduling or cluttered aisles or aisles of insufficient size to provide unhampered movement of the truck, it makes no difference what speed the truck is capable of making in the clear. And when the metal arrives at the pouring zone, the molds must be ready to receive it.

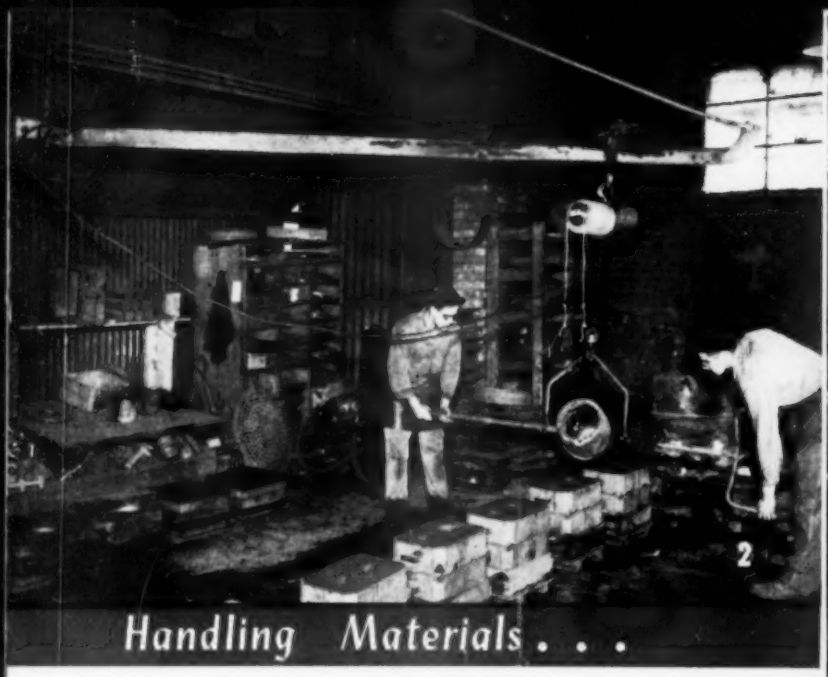
Movements Must Be Synchronized

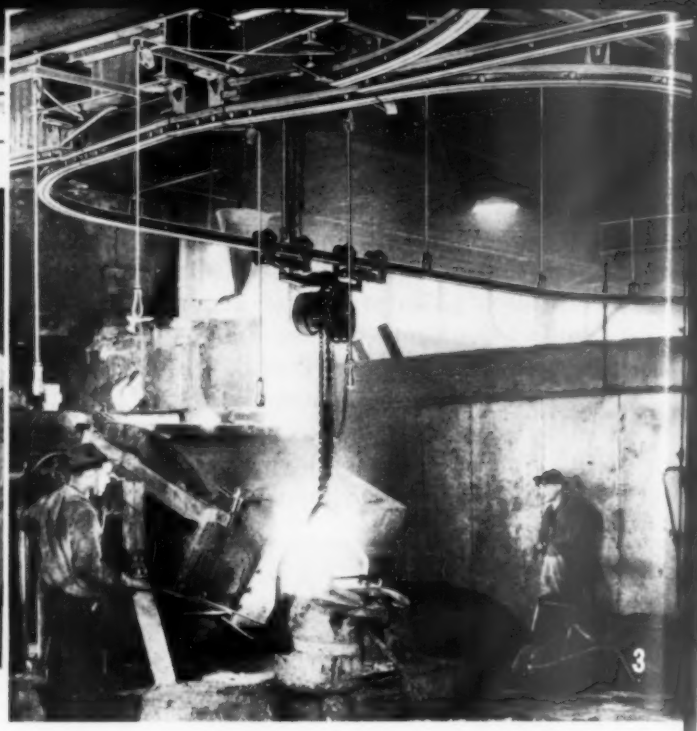
More than in any other phase of foundry operation, all factors involved in turning molten metal into castings must be synchronized properly. There is no provision for storage where a reserve supply can be built up to smooth out the hills and valleys in supply and demand of molten metal and molds. It is strictly a hand to mouth proposition and the use of proper equipment backed by intelligent production planning are mandatory in maintaining the smooth, even flow of operations so necessary for quality and economical production.

The sequence of views in Fig. 1 shows the step by step movement of metal from a cupola to the molding floors along an overhead monorail conveyor. The system of switches and spur rails to carry the ladles from the cupola to the various floors is shown in View A. View B shows the distributing ladle being pushed away from the cupola area and entering a molding floor in View C. View D shows the transfer of metal to a pouring ladle operating on a moveable section of runway which services one of the bays in the molding area. Pouring off the molds is shown in View E.

The distributing ladle shown in these views is a

Fig. 1, A to E—Sequence of metal carrying operations from the cupola spout to the mold





Handling Materials . . .

21½-in. top diameter, 1000-lb capacity, covered, straight sided ladle. The smaller pouring ladle is a 13½-in. top diameter, covered, tapered ladle. These ladles are mounted in a pouring device suspended from a trolley which rolls along the overhead runway. The pouring device provides for raising and lowering the ladle through a rack and pinion arrangement operated by the large wheel above the ladle. Tilting the distributing ladle for pouring is accomplished through a gear arrangement by turning the wheel at the side of the ladle. These controls can be seen most clearly in Views A, B, and C. Pouring from the small ladle is controlled by a simple lever as shown in View E.

Ladles Switched to Runway

Another overhead monorail installation for conveying ladles of molten metal is shown in Fig. 3. The overhead monorail loop at the furnace will accommodate a number of ladles waiting to be filled without interfering with movement of the filled ladle off the loop through a switch to one of the runways leading to a pouring station. Raising and lowering the ladles is accomplished through a chain hoist attached to the trolley on the monorail. The ladle is tilted by a simple T-bar pouring device.

Use of a swinging wall bracket crane for covering a section of the molding floor during pouring operations is shown in Fig. 2. The crucible and T-bar carrying and pouring device is supported by a removable bail suspended from a 1-ton capacity electric hoist which is hooked to a trolley riding on the crane arm.

Fig. 4 provides a view of another overhead tramrail system used to carry ladles from the cupola to the pouring station. The illustration shows a ladle on a bridge over the mold floor. The ladle has a capacity of 300 lb and is electrically raised and lowered. In the medium mold floor serviced by this ladle, 139 molds and 11,000 lb of metal are poured per day.

Use of an overhead tramrail system to transport a pouring crucible over a molding floor where the molds are carried on gravity roller conveyors is shown in Fig. 5. When the molds have been poured they are pushed off the end of the conveyors onto the shakeout rack pictured. The sand falls through a grating and the castings are heaped on the floor beyond the knock-out rack, to be picked up later and transported to the celaning room.

Combined use of gravity roller conveyors, power mold conveyor, overhead power conveyor, and overhead crane in an integrated molding-pouring area is shown in Figs. 6 and 7. Molds are made in the left background of Fig. 6 and are poured on the gravity conveyors located in the center of the power mold conveyor oval. The bottom pour ladle in this view of a steel foundry is carried by an overhead crane which positions it over the molds for pouring. Poured molds are puched off the gravity roller conveyors onto the power mold conveyor, which permits a variation in cooling time of the molds before they are transported to the shakeout. The conveyor in the upper lefthand corner of Fig. 7 picks up the molds when they have cooled sufficiently and transports them to an automatic shakeout.

Overhead cranes fulfill a number of materials handling applications in the pouring department. Holding and transporting of ladles is pictured here. In addition, cranes are used to move molds from molding machines or molding area to pouring area and away from the pouring area. With special attachments they are used in shaking out castings. Examples of this application will be shown in the next article in this series, dealing with materials handling operations in the shakeout department.

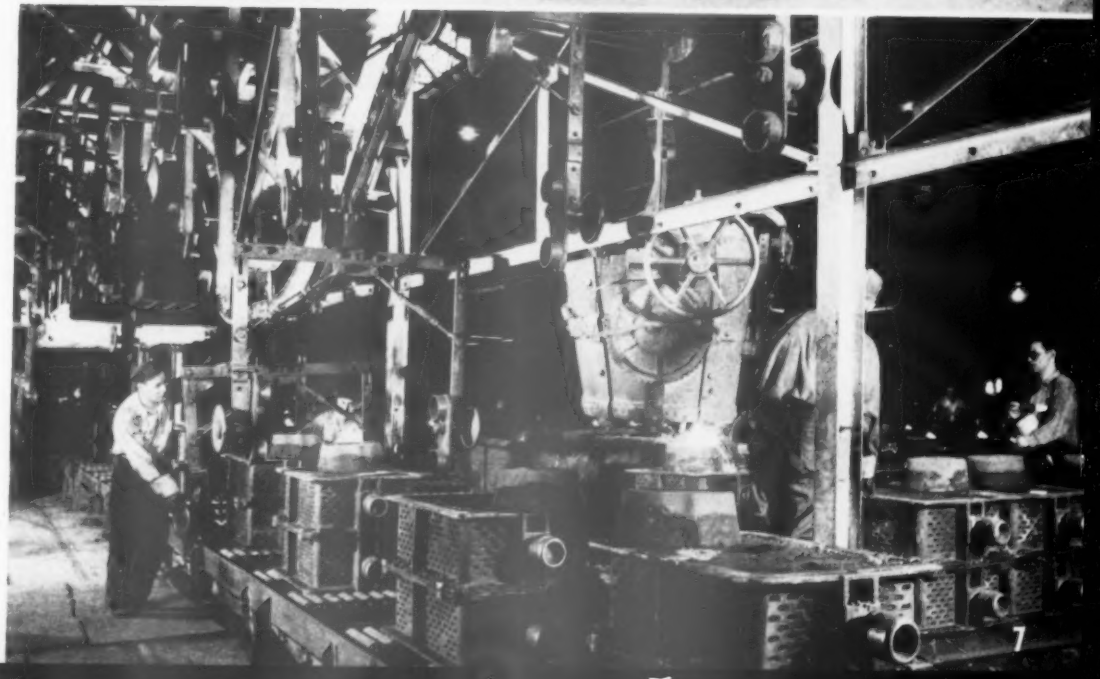
The elevation of molten metal from the melting

Fig. 2 — Electric chain hoist on a wall bracket crane supports crucible during pouring

Fig. 3 — Simple monorail loop for tapping furnace with bull ladle

Fig. 4—Overhead tramrail system carries ladle for pouring molds

Fig. 5—Overhead tramrail carries crucible servicing molds on gravity roller conveyors



Figs. 6 and 7 — Combined use of gravity roller conveyors, power mold conveyor, overhead power conveyor, and overhead crane in an integrated molding-pouring area

room on the first floor of a large, jobbing type, aluminum foundry to the permanent mold department on the third floor is illustrated in Fig. 8. Transfer of the molten aluminum is accomplished automatically. The 400-lb capacity ladle is moved from the furnace area by an electrically driven carrier on an overhead monorail to its position on an elevating section of monorail as shown in Fig. 8. Upon arrival at the third floor, the ladle is connected to a continuation of the monorail system leading to thirty 350-lb capacity holding furnaces and the metal transferred.

Provides Quick Distribution of Metal

Fig. 9 shows a furnace being tapped into a 5½-ton molten iron carrier. The unit has a lift of 6 ft with upper limit switch and hoisting speed of 21 fpm. The carrier unit is operated on 220 v dc and is equipped with variable speed control. Maximum speed is 350 fpm. Because the carrier travels above all obstacles on the floor, such an installation provides for quick distribution of metal to the pouring area. The operator travels with the unit and controls all operations from his position in the cab.

Pouring molds on a power conveyor equipped with an automatic weight placing device is shown in Fig. 10. As the conveyor brings the molds to the pouring station, the weight-carrying monorail makes a downward jog, dropping the weights on the molds. At the end of the pouring station the monorail makes an upward jog and the weights are lifted off the molds. The monorail conveyor then circles back to the start of the pouring station where the weights again are dropped on the molds, and the mold conveyor continues on to the shakeout area. The 12-in. open, tapered ladle shown in the illustration is suspended from a single hook on the rack and pinion, height adjusting device attached to a monorail trolley. When pouring the molds, the pourer walks beside the conveyor, and the single hook suspension enables him to hit the sprues on the various molds even though they are not placed in a straight line on the conveyor. This type of arrangement is very flexible.

Pouring molds on mold conveyors which pass through ventilating hoods is shown in Figs. 11 and 12. Smoke and fumes developed in the molds immediately after pouring are drawn off in the hoods and carried away by the ventilating system. Cooling of the filled molds also is aided by such arrangements. In the installation shown in Fig. 12, the conveyor carries the molds from the hood immediately to the shakeout zone where they are discharged automatically to an oscillating trough conveyor and then to the shakeout. Bottom boards are retained on the mold conveyor and returned to the molders.

Fig. 13 shows the pouring sation at a large production foundry. Each of the mold carrying power conveyors passes under a monorail on which the ladle-carrying dollies travel. The pourers stand on a movable section of flooring which travels at the same speed as the mold conveyor, and pouring ladles are suspended by a single hook, which simplifies pouring molds placed at random on the mold conveyor. Raising and lowering the ladles is accomplished by a lever-operated device which suspends the ladles from the dollies.

Sources of Illustrations

Figs. 1 and 10—Modern Equipment Co., Port Washington, Wis. Fig. 2—Whiting Corp., Harvey, Ill. Fig. 3—American Monorail Co., Cleveland. Fig. 4—Cleveland Tramrail Div., Cleveland Crane & Engineering Co., Wickliffe, O. Fig. 5—Standard Conveyor Co., St. Paul. Figs. 6 and 7—Chain Belt Co., Milwaukee. Fig. 8—Jervis B. Webb Co., Detroit. Fig. 9—Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y. Fig. 11—C. O. Bartlett & Snow Co., Cleveland. Fig. 12—Link-Belt Co., Chicago. Fig. 13—Jeffrey Mfg. Co., Columbus, O.

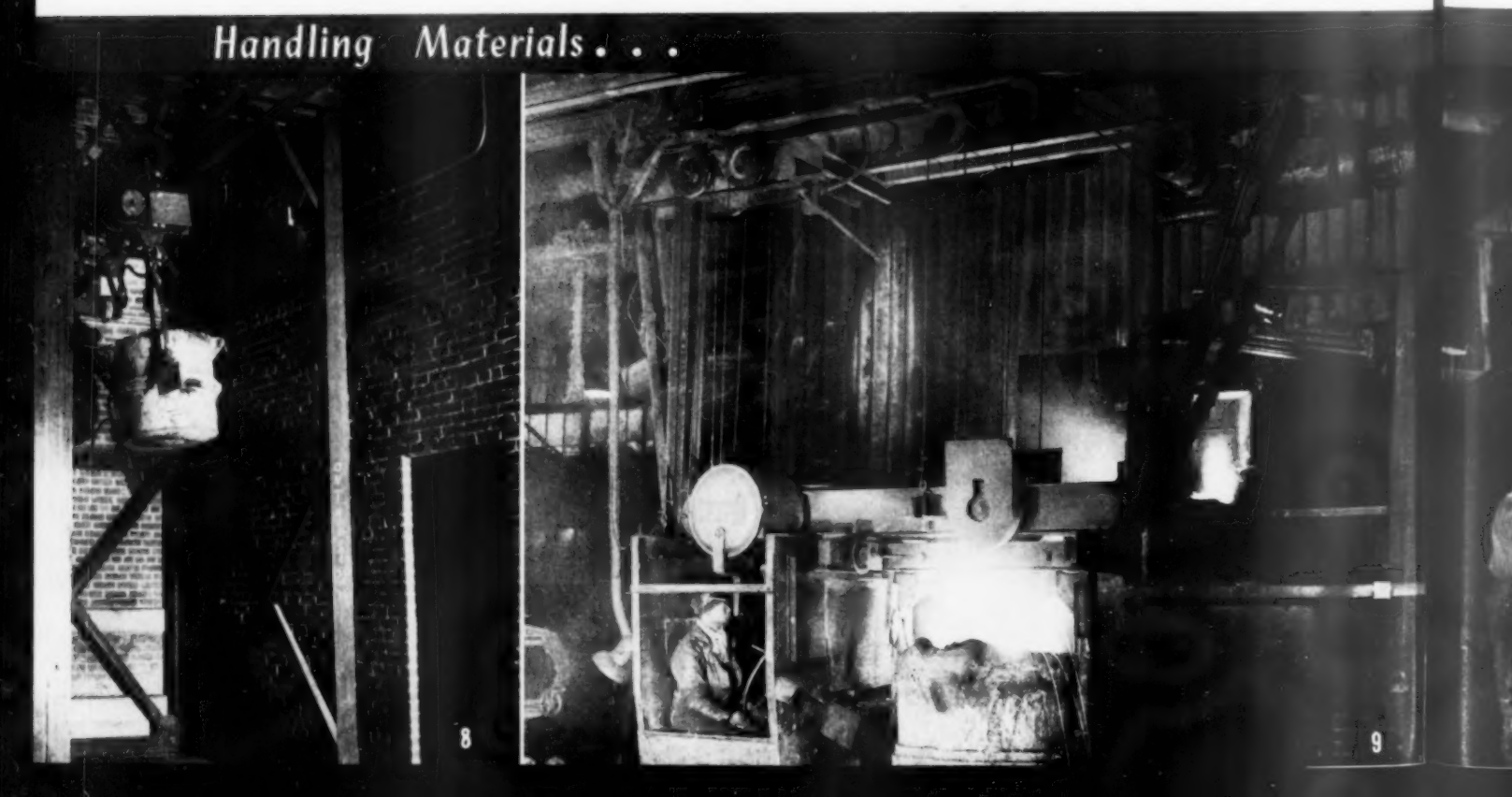


Fig. 8—Elevating section of overhead monorail for moving ladle of molten metal to upper floor

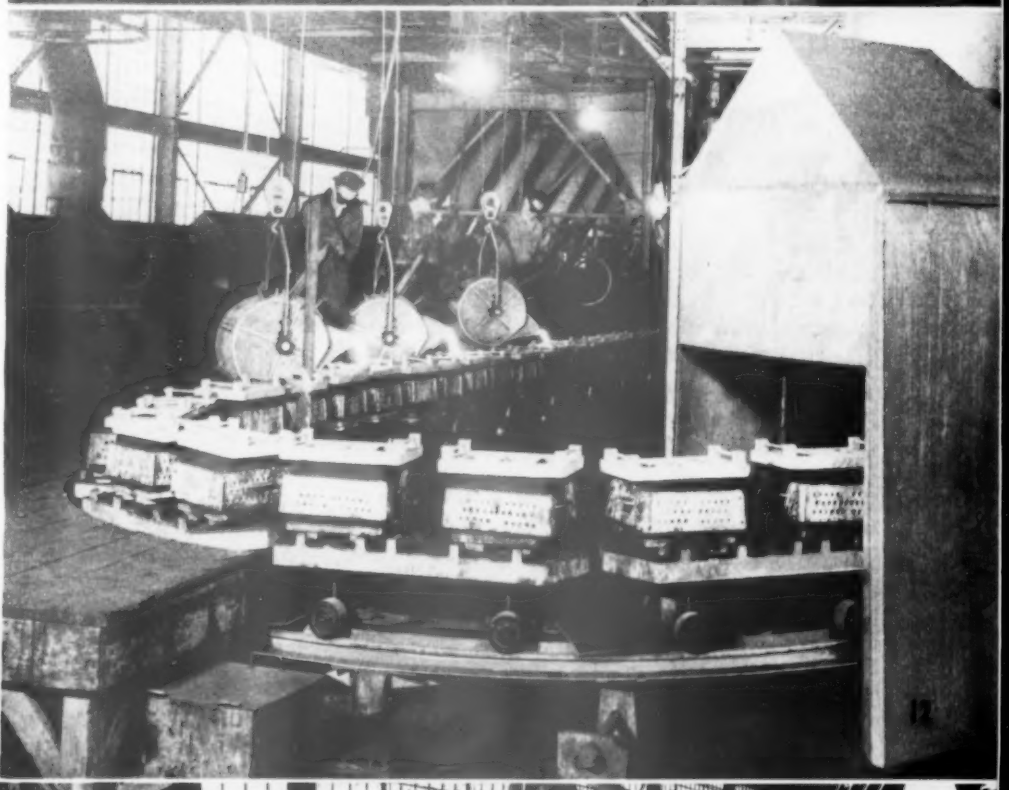
Fig. 9—Molten metal carrier with control cab

Fig. 10 — Automatic weight-placing device services this power mold conveyor

Fig. 11—Ventilating hood for power mold conveyor

Fig. 12—View of another ventilating hood over a power mold conveyor

Fig. 13 — Moving platform carries pourers at same speed as mold conveyor



CUPOLA DUST C

This first of two articles on the subject of cupola dust collection discusses properties and quantities of emissions from the cupola under various operating conditions. A second article will describe the different types of equipment employed to remove dust from cupola stack gases

By WILLIAM N. WITHERIDGE
Ventilation Consultant
General Motors Corp., Detroit

THE cupola is a vertical, cylindrical "wind-furnace" for the melting of metal and the liquefaction of wastes for convenient removal. It requires on the order of 1 to 1½ tons of air for every ton of iron melted, and the gases leaving the cupola carry with them from 10 to 50 pounds of dust for every ton of metal produced. Because of this latter circumstance the cupola operator today is feeling the force of an accelerated program of air pollution control, and is examining methods for flue dust or fly ash suppression.

The properly operated cupola has been called the most efficient of all melting furnaces, because the fuel is in direct contact with the charge. Nevertheless, it would be a mistake to overstress the desirability of attaining ever higher fuel combustion efficiency. Contrary to the single goal of highest possible combustion efficiency in burning fuel for heat and power generation, operation of a cupola has the two-fold objective of economy and metallurgical control.

"Maximum economy is not attained with maximum efficiency of combustion, since the saving in coke will not counterbalance the cost of the elements lost[1]" (such as silicon and manganese).

In addition to the melting process, there is also the concurrent operation of a reducing-oxidizing equilibrium between the carbon monoxide and dioxide present in the "heat-treating" atmosphere. So far as oxygen is concerned, the process is adjusted to consume most or all of it as rapidly as possible before the gases reach the melting zone, in order to avoid an excessive oxidation loss of iron, silicon, and manganese. If the brown smoke of oxidized metal passes out of the stack, it suggests a waste of valuable materials.

Properties of Solid Emissions—An effective attack upon a problem of air or gas cleaning is based upon some knowledge of the constituents of the contaminated gas. When this information is lacking, a project of stack gas sampling is in order. Before approaching the job of sampling and analysis it is well to know the nature of the process causing the contaminants.

The solid matter in ferrous cupola stack gases is heterogeneous both in size and composition. In size it ranges chiefly from 1 (*Please turn to page* 198)

TABLE I—Cupola Sizes and Nominal Melting Rates*

Iron to Coke Ratio, 10:1 (a)

Cupola Size Number	Shell Diam, in.	Diam Inside Lining (b), in.	Inside Cross-section Area (b), sq ft	Nominal Melting Rate Tons/Hour Fe/Ck=10	Iron Melted lbh/sq ft	Air Blast lbh/sq ft
0	27	18	1.8	1¼	1390	1110
1	32	23	2.9	2	1380	1100
2	36	27	4.0	2¾	1380	1100
3	46	32	5.5	4	1450	1160
3½	51	37	7.5	5¼	1400	1120
4	56	42	9.6	7	1460	1170
5	63	45	11.0	8	1450	1160
6	66	48	12.6	9	1430	1140
7	72	54	15.9	11½	1450	1160
8	78	60	19.6	14	1430	1140
9	84	66	23.8	17	1430	1140
9½	90	72	28.3	20¼	1430	1140
11	102	78	33.2	23¾	1430	1140
12	108	84	38.5	27¾	1440	1150

* Adapted from Table 2, p 20-21 and Table 6, p 100-101, AFS *Handbook of Cupola Operation* (1946)

(a) for other coke ratios, assume nominal coke charge of 150 lb per hr per sq ft of cross-sectional area inside the lining at the melting zone. (Range is about 100-200 lbh/sq ft)

(b) straight shaft cupola assumed for convenience

TABLE II—Sulphur Balance in Operation of Fo

(An idealized example of conventional operation with side chargi a melting rate of 10 tons of iron per hour, as one-hour the heat)

Lb/hour	Materials
20,000	iron and steel charged
2,500	coke charged (above "bed-coke")
25	sulphur brought in with coke
20	aggregate of sulphur in metal charge
20,000	air blast (this is in lb/hr, about 26,000 cu ft per ton of iron)
22,000	effluent gas from combustion zone
8,000	dilution air induced through charging door of 12 sq ft area at 150 cfm/square foot
30,000	combined gas and air leaving stack
1,500	slag removed from melting zone (including iron loss of 5%)
28.5	sulphur removed in molten iron (before desulphurizing, as in a forehearth)
7.5	sulphur removed in the slag
9	sulphur carried up with stack gas

Concentration of Sulphur in the Effl Stack Gas

9/30,000=300 parts sulphur per million parts of gas by weight

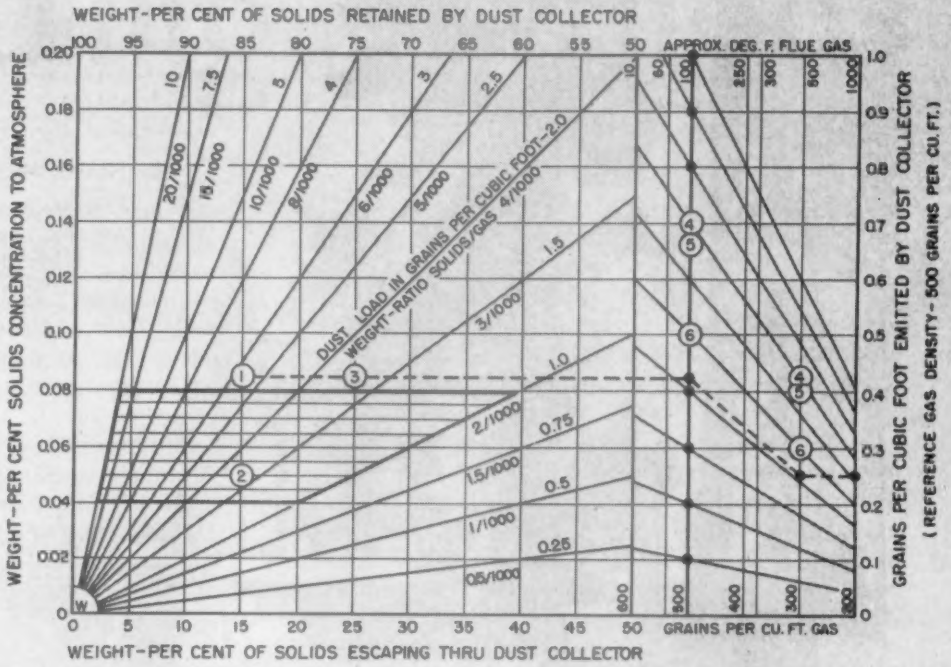
Assuming that as much as 50% of this sulphur is discharged in the gaseous form as SO_2 (remaining sulphur present as particulate compounds): 2(300/2) ppm sulphur=300 ppm sulphur dioxide by weight

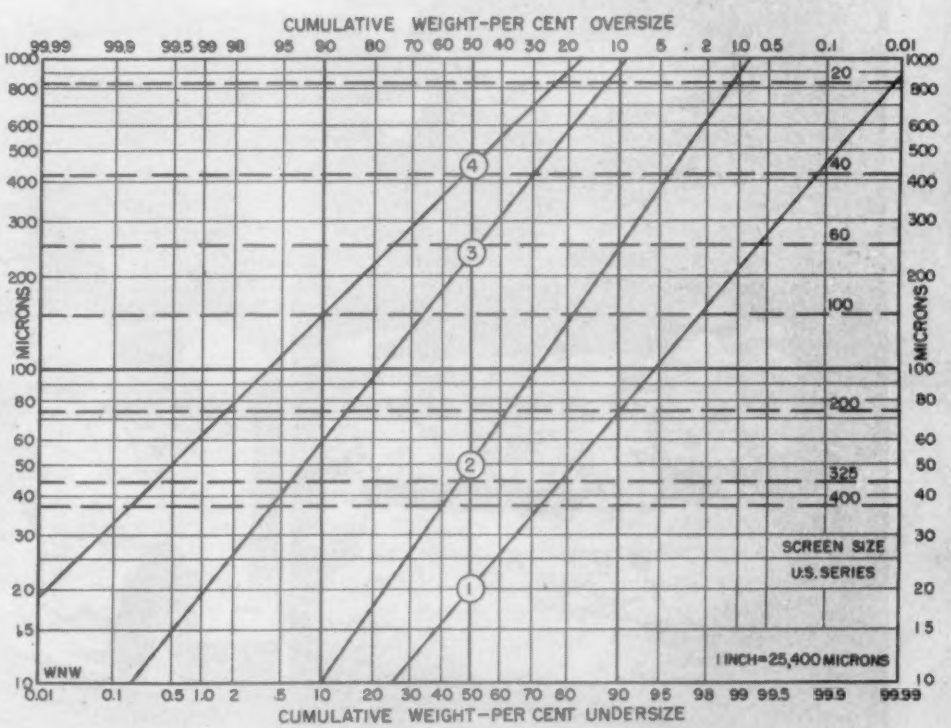
300 ppm by weight times 30/64 equals 140 ppm by volume (30 is the assumed molecular weight equivalent of cupola stack gas; note that the dilution ratio Gs/Gc is only 1.36.)

COLLECTION

Fig. 1 (above right)—Dust loading and collection efficiency diagram with temperature correction chart. Numbered points represent following permissible emissions: 1. ASME model ordinance (1949), approximately 0.25-grain/cf at 500°F. 2. Allegheny county (1949), new blast furnaces, approximately 0.15-grain/cf at 500°F. 3. Allegheny county (1949), foundry cupolas, approximately 0.25-grain/cf at 500°F. 4. Cleveland (1949), 0.425 grain/cf at 500° F. 5. Los Angeles (1949), 0.4-grain/cf (see text). 6. Detroit (1947), 0.3-grain/cf at 500°F.

Fig. 2 (below right)—Relative size distribution of several dusts: 1. Pulverized coal fly ash samples. 2. Cupola flue dust samples. 3. Insoluble portion of solids collected by wet dust arrester. 4. Single dust sample settled on roof near cupola


WEIGHT-PER CENT OF SOLIDS RETAINED BY DUST COLLECTOR
APPROX. DEG. F. FLUE GAS
WEIGHT-PER CENT SOLIDS CONCENTRATION TO ATMOSPHERE
GRAINS PER CUBIC FOOT EMITTED BY DUST COLLECTOR
(REFERENCE GAS DENSITY-500 GRAINS PER CU. FT.)
DUST LOAD IN GRAINS PER CUBIC FOOT-2.0
WEIGHT-RATIO SOLIDS/GAS 4/1000
GRAINS PER CU. FT. GAS
WEIGHT-PER CENT OF SOLIDS ESCAPING THRU DUST COLLECTOR



...ration of Foundry Cupola

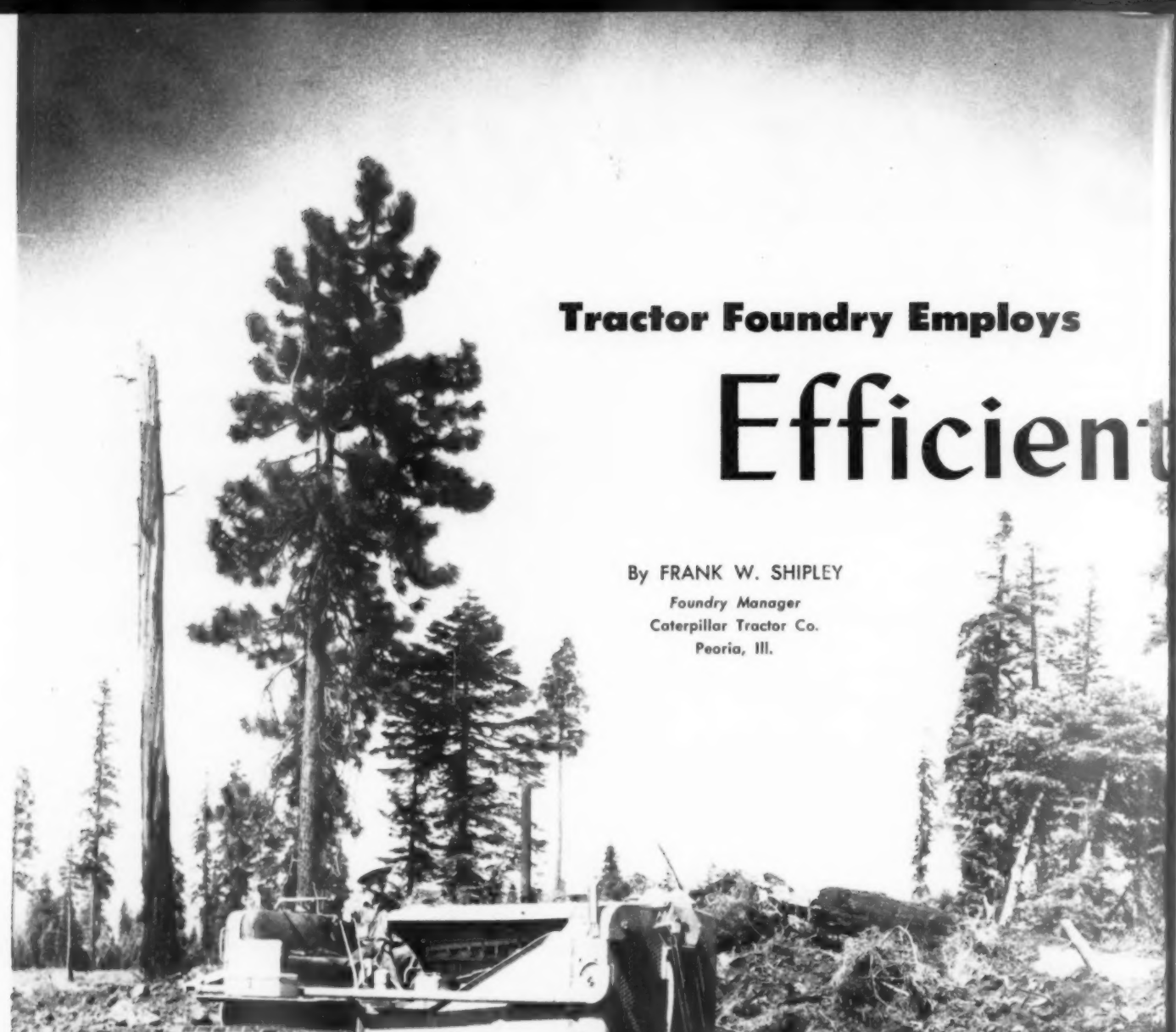
...on with side charging door open, ... one-hour period during

...ools	Ratios	
...Fe		
...Ck	Fe/Ck	= 8.0
...Sk	Sk/Ck	= 0.01
...Sa	Sa/Fe	= 0.001
...Ab	Ab/Ck	= 8.6
...Gc	Gc/Ab	= 1.1
...Al	Al/Gc	= 0.36
	Gs/Gc	= 1.36
...Gs	Gs/Ab	= 1.5
...Ws	Ws/Fe	= 0.075
...Sz	Sz/Sa	= 1.5
...Ss	Ss/Ws	= 0.005
...Stack Gas		
	Sg/Gs	= 0.000,300
	SO_2/Gs	= 0.000,300

Tractor Foundry Employs

Efficient

By FRANK W. SHIPLEY
Foundry Manager
Caterpillar Tractor Co.
Peoria, Ill.



Caterpillar Tractor Co. in 1948 produced 3,302,467 castings from 4200 patterns. These castings varied in weight from ½ to 3400 pounds and were made in lots ranging from 1 to 15,000 pieces per month. How the company accommodates such variations by accurate scheduling is described in this paper, which was presented before the last Michigan Regional Foundry Conference at Michigan State College

Scheduling Methods

USUALLY when we think of production foundries we picture highly mechanized units specifically engineered to produce a particular casting or group of castings similar in size and shape. The same castings are produced day after day, week after week in quantities of many hundreds of thousands. This articles will discuss an entirely different type of production.

Caterpillar Tractor Co. produces many hundreds of thousands of different castings, from thousands of different patterns, and from extremely small lot sizes to extremely large lot sizes. As an illustration, in 1948 we produced in our foundry 3,302,467 castings from 4200 patterns. These castings averaged 35 lb each in weight, and varied from ½ to 3400 lb. Production lot sizes range from 1 piece to 15,000 pieces a month. In addition, these castings were made from nine different metallurgical specifications set up by the engineering department.

We pride ourselves on the fact that we have no orphan equipment in the field regardless of its age, consequently we have orders on some of these parts for one casting per year. Also, we produce many special attachments for our customers which may require very small lot sizes. Naturally, this great variety of castings and lot sizes calls for both accurate scheduling and careful planning of molding and coremaking units. In order to get a better picture of the facilities for producing these castings the molding units and corerooms, as well as the methods of scheduling, will be described.

To give an idea of the type of castings produced, Fig. 1 shows the D8 tractor, the largest we manufacture. There are 238 gray iron castings in this tractor, varying in weight from 1 to 3400 lb and in lot sizes from 450 to 10,000 pieces a month. Fig. 2 is the large V12 industrial engine. There are 215 gray iron castings in this engine, varying in weight from ½ to 2780 lb and in lot sizes from 40 to 960 pieces a month.

Fig. 1—The D8 tractor, largest manufactured by Caterpillar Tractor Co., Peoria, Ill.
Fig. 2—The large Caterpillar industrial engine
Fig. 3—Largest and smallest cylinder blocks made on the foundry's No. 1 unit

In addition to several different models of track type tractors and industrial engines, we also produce auto patrols, motor graders, bulldozers, scrapers and all types of earthmoving equipment, all of which require some gray iron castings.

Fig. 14 is a scale layout of the complete foundry. As will be noted, there are ten different molding units in the molding department. The largest unit, which we shall discuss first, is used to produce transmission cases and cylinder blocks. Fig. 3 shows the largest and smallest cylinder blocks and gives some idea of the extremes in casting sizes produced on the No. 1 unit. The largest cylinder block weighs 2780 lb and is made in a flask 57 x 89-in., 25-in. cope and 25-in. drag, and when poured, the combined weight of the flask, sand and metal is 26,252 lb. The cores in the casting weigh 5,777 lb.

The small cylinder block weighs 384 lb and is made two in a flask 36-in. x 85-in., 14-in. cope and 14-in. drag, and the combined weight of the flask, sand and metal is 10,044 lb. The cores in this casting weigh 393 lb.

Other castings made on this unit, with the exception of the largest transmission case, range in size between these two extremes. All pattern equipment and pattern stripping machines, excepting the largest transmission case, are of a type that can be run on the next size unit in the event production requirements are such that we are overburdened on the large unit. While this rarely has happened, we have found it necessary to change units where production requirements have been reduced when the part has become non-current.

No. 1 unit, on which these castings are made, consists of a drag conveyor, a cope conveyor, slinger ramming units and sand conditioning system. Two electrically driven cars carry the cope and drag patterns, which are mounted on power stripping machines set loose in the car. This affords easy and rapid changing of patterns. While the drag half of the mold is being rammed by the slinger, the cope

Efficient Scheduling

FOUNDRY PRODUCTION FOLLOW-UP SHEET

UNIT NO. Cope and Drag — SCHEDULE BEGINNING May 1, 1949

PART NO.	PART NAME	SX %	Mach. Model	OR C	Flask	pcs per Mold	pcs per hr or Burden	Sched.	Quantity	2	3	4	5	6	9	10	11	12	13	16	17	18	19	20	23	24	25	26
361-A	Seat	3	217	C	1C126	1	2	6	35																			
8B-378	Liner	6	182																									
			217	C	2B3712	1	6.9	7	16825																			
L-610	Cyl.Bd.	9	182	C	L610	1	1.5	3-6	30																			
L-688	Drum	5	182	S	3906	1	6.12	3-7	73																			
3B-973	Cl.Fl.	7	182	S	2753A	1	8	7	20																			
2A-1037	Hub	3	142	C	2A3284	2	15	3-5	204																			
								3-6	1729																			
								3-7	671																			
1F-1230	Brg.Cap	2	142	C	L610	5	21	6	283																			
								7	150																			
3B-1393	Hub	3	142	C	3226	4	28	3-7	150																			
2B-1309	Drum	7	217	S	1520A	1	5	7	60																			

FORM #79-12250 — RECAPITULATION OF CORE ROOM SCHEDULING SHEET

	BENCH LARGE	BENCH SMALL	CHAMPION LARGE	CHAMPION SMALL	SB-10	SB-11	SB-11 LARGE	SB-11 SMALL	SB-17	IRON.	DCN #2	DCN #3	DCN #4
#6 UNIT		12.34				24.50					2.72		
CHILL FLOOR				4.26		18.76		3.01	2.73				
#9 UNIT		25.93		1.82		20.40					2.67		1.26
COPE & DRAG		22.23	9.08	14.79	3.10	24.98		25.03	5.12				
SANDSLINGER	32.91	44.55	16.73	28.33	18.59	27.30		10.55	35.58	65.50	16.62	21.60	13.55
STARTING MOTOR		25.67	7.84	13.83		7.69	8.57	4.79	.16				
LINERS				1.93			12.96						
SUB-TOTAL	32.91	130.72	33.65	71.96	21.69	123.63	21.53	43.38	43.59	65.50	22.01	21.60	21.81
PLUS 10%	3.29	13.07	3.37	7.20	2.17	12.36	2.15	4.34	4.36	6.55	2.20	2.16	2.18
LOOSE WORK	11.80		10.95										
TOTAL HOURS	48.00	143.79	47.97	79.16	23.86	135.99	23.68	47.72	47.95	72.05	24.21	23.76	23.99
AVAILABLE HOURS	48.00	144.00	48.00	80.00	24.00	136.00	24.00	48.00	48.00	72.00	24.00	24.00	24.00

AVAILABLE HOURS	LARGE CORE ROOM	264.00
AVAILABLE HOURS	SMALL CORE ROOM	480.00
SCHEDULED HOURS	LARGE CORE ROOM	263.64
SCHEDULED HOURS	SMALL CORE ROOM	478.49

4

5

Fig. 4—Typical daily burden summary of all core machines

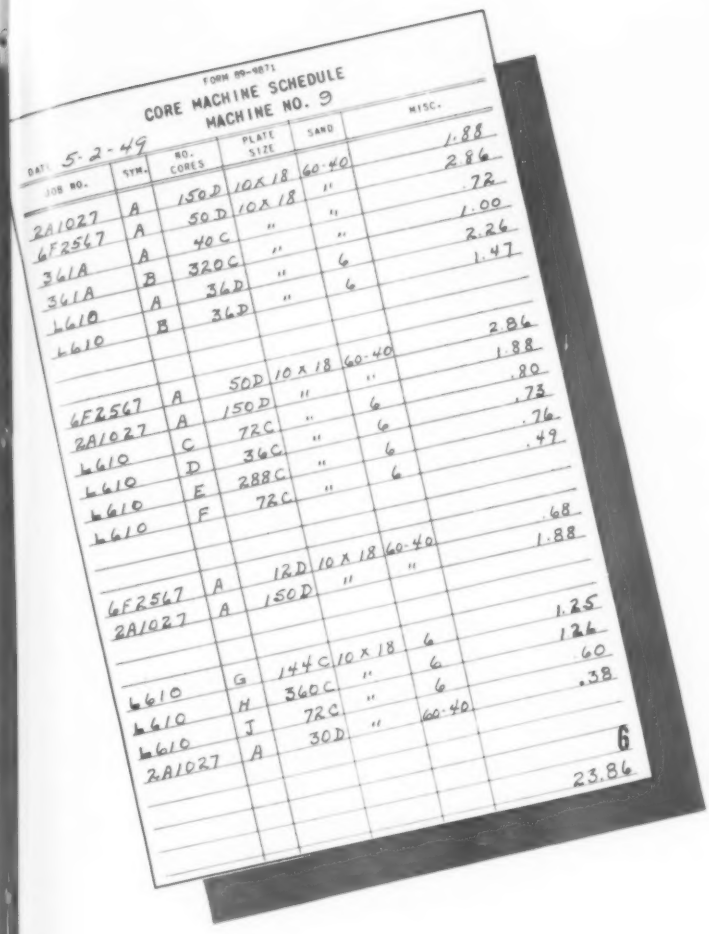
Fig. 5 — Foundry production follow-up sheet

half is being prepared for ramming. After the drag is rammed, the pattern car is moved under a stationary strike-off bar, the mold struck off, stripped and placed on the conveyor. This drag conveyor consists of 37 cars each 6½ x 9 ft, with a transfer car at each end. The conveyor, which is powered by a hydraulic push-pull system, moves intermittently. The time cycle is controlled automatically and can be changed to coincide with the ramming cycle of each different job.

The mold is sprayed and dried to a depth of approximately ⅜-in. by means of a gas air torch. Cores are set as the conveyor moves along to the closing station, by means of a gantry crane. Meanwhile the cope is placed on its own conveyor, sprayed and dried, rolled over, and the runner box positioned and rammed with a smaller sandslinger. Then the mold is closed and poured. An electrical device is used to minimize the amount of iron left in the runner box. The mold passes through a cooling tunnel which requires at least 1½ hr from the time of pouring. Then the casting is removed with the core intact and moved to the cleaning room by means of conveyor. The cope and drag half of the mold is shaken out on a large vibrating screen and the flask returned to the slinger to start another cycle. Space on top of the cooling tunnel is provided for flasks not in use. As many as four pattern changes per day are made on this unit and each change can be made in a very few minutes.

Fig. 15 is a group of castings representative of the type and sizes made on our Nos. 2 and 3 molding units. They range from light-weight, thin-section flywheel housings to medium-size transmission cases. Flask sizes range from 28 x 28-in. with 13-in. cope and 6-in. drag, to 46 x 65-in. with 16-in. cope, 16-in. drag.

The Nos. 2 and 3 molding units are identical in design and consist of a tractor type sandslinger, behind which are two pattern cars pulled by the slinger. Each car carries a pattern power stripping machine, set loose in the car, one for the cope and



FORM 89-9871

CORE MACHINE SCHEDULE

MACHINE NO. 9

DATE 5-2-49

JOB NO.	SYM.	NO. CORES	PLATE SIZE	SAND	MISC.
2A1027	A	150D	10X18	60-40	1.88
6F2567	A	50D	10X18	"	286
361A	A	40C	"	"	.72
361A	B	320C	"	6	1.00
L610	A	36D	"	6	2.26
L610	B	36D	"		1.47
6F2567	A	50D	10X18	60-40	286
2A1027	A	150D	"	"	1.88
L610	C	72C	"	6	.80
L610	D	36C	"	6	.73
L610	E	288C	"	6	.76
L610	F	72C	"	6	.49
6F2567	A	12D	10X18	60-40	.68
2A1027	A	150D	"	"	1.88
L610	G	144C	10X18	6	1.25
L610	H	360C	"	6	126
L610	J	72C	"	60-40	60
2A1027	A	30D	"		.38
					6
					23.86

Fig. 6—Typical daily core machine schedule

one for the drag. While one half of the mold is being rammed the previously rammed half is being removed and placed on the floor and another flask placed on the pattern by means of a crane. Molds, after being placed on the floor, are sprayed and dried, cores set by means of an overhead crane, closed and poured on the floor. This operation is repeated until the scheduled quantity of molds has been rammed, at which time the patterns still mounted on the machines are removed and patterns which were previously mounted on another set of pattern stripping machines are set in place on the pattern car. This affords quick changeability of patterns, as on No. 1 unit, because patterns can be mounted on pattern stripping machines during regular operations and changed at will in a few minutes.

All shakeout operations are performed on third shift. Flasks are shaken out on the floor and then placed along the side in the sequence in which they are to be used the next day. The sand heaps, consisting of approximately 100 tons each, are reconditioned by adding a heavy rebonded sand and cutting the entire heap with a sandcutter.

Production on each unit ranges from 150 to 200 molds a day from approximately five to 10 patterns on each unit. Although these units are not fully mechanized, they are very practical for a number of reasons: (1) Few men are required, (2) patterns can be changed rapidly, (3) production schedules can be very flexible, (4) fewer flasks are required for each job.

Fig. 16 is a representative group of castings produced on Nos. 4 and 5 units. No. 4 is set up principally for producing diesel cylinder heads of all sizes and shapes. No. 5 is merely a floor for producing chilled track carrier rollers.

Unit No. 4 is a roller conveyor powered by air cylinder pushers and is moved intermittently as mold production requirements warrant. There are two stationary sandslingers, one for the cope and the other for the drag. Patterns used on this unit are mounted on the same type power stripping machines as those on the other units. As each half of the mold is placed on the conveyor, it is sprayed and dries as it passes through an automatic gas-fired mold drier. Molds move to the coring station where they are cored and gaged and then to the closing station where they are checked with an overall gage, closed and poured.

After cooling, the casting is lifted out and the flask shaken out and returned by roller conveyor to the ramming station. Production schedules on this unit vary from 10 to 1000 pieces a month from 25 different patterns. Here again is a unit which lends itself to flexibility, as patterns are mounted on power stripping machines and moved into ramming position without interrupting production.

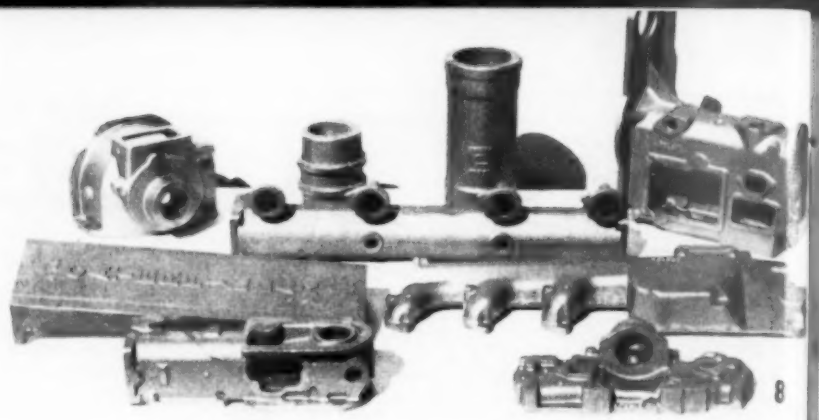
Poured in Iron Molds

In this same bay at one end of the conveyor unit is the No. 5 unit, used to produce castings known as chill track carrier rollers. These castings serve as idlers to support the upper part of track for our track type tractors. They must withstand severe conditions of abrasion from mud, ice, snow, sand and gravel. Iron molds are used to chill the wear surface of castings to a predetermined depth. These molds are assembled on the floor in rows and spaced to be poured from a multiple spout teapot ladle which pours four at a time. There are about 15 different kinds of these chilled rollers which are made in lots of 200 to 2000 pieces a month.

Fig. 7 shows a group of castings representative of those produced on our No. 6 unit. They vary from ½ to 49 lb. The number of pieces produced from a given pattern varies from 1 to 6000 pieces a day. No. 6 unit consists of a power-driven conveyor having 176 tilt-top cars with 2 ft 3-in. centers which travel at a maximum speed of approximately 12 cars per minute. The molds, one per car, are automatically shaken out. There are 18 jolt squeeze machines, each having an individual sand hopper above the machine. A sand conditioning system can be operated either automatically or manually.

The molds are rammed in pop-off flasks and then placed on the conveyor which runs parallel with the machines. The molds range in size from 12 x 12-in. with 6-in. cope and 4-in. drag, to a 14 x 20-in. with 9½-in. cope and 4-in. drag. Here again flexibility prevails. Jobs are rigged for the flask before they are run so that no time is lost changing jobs. Total

7



8

Efficient Scheduling

Representative groups of castings produced on the various foundry molding units. Those from No. 6 unit are shown in Fig. 7; castings from Nos. 7 and 8 units are shown in Fig. 8, and from No. 9 unit in Fig. 9
Fig. 10—Core assembly and sawed casting of opposed cylinder gasoline starting engine. Fig. 11—Wire shape and form reference board. Fig. 12—Foundry burden recap sheet. Fig. 13—Molding schedule for several units

production on the unit can be varied readily by reduring or increasing the number of molders working on the unit at one time.

Fig. 8 is a representative group of castings produced on Nos. 7 and 8 molding units, which we refer to as a cope and drag unit. Castings range in size from 1 to 200 lb. Quantity per day from any one pattern varies from 1 to 4000 pieces. Castings produced on this unit are made from approximately 525 patterns each month. Flask sizes range from 13 x 18-in. with 8-in. cope and 5-in. drag to 29 x 31-in., 8-in. cope and 8-in. drag.

Nos. 7 and 8 units are identical with respect to equipment and have a common sand system. Each unit has 87 cars with 5-ft centers which travel approximately six cars per minute maximum. Molds are rammed in steel flasks on either jolt-squeeze rollover draw machines or jolt-squeeze stripping machines of several different sizes. Molding sand is supplied to each machine by an overhead sand hopper. After the molds are rammed they are placed on the conveyor, cores are set, molds are closed and poured, after which they pass through a cooling tunnel on their way to the shakeout.

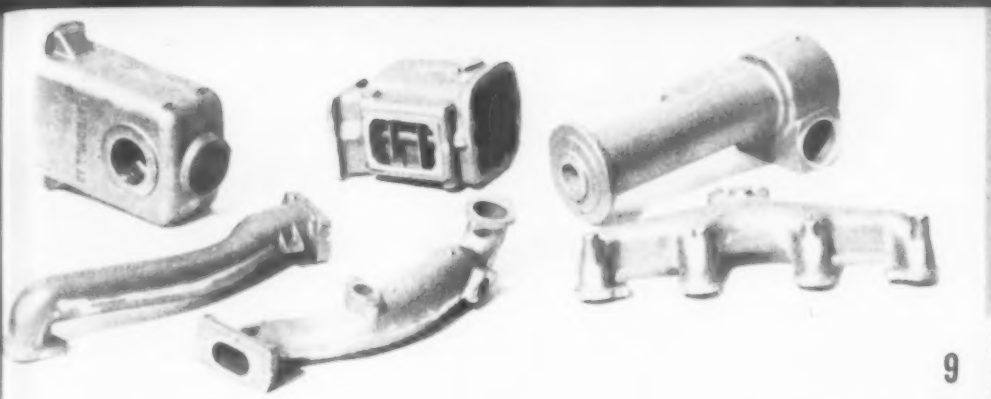
By having various types and sizes of molding machines on each of these units considerable variety is attained in mold sizes. Additional flexibility is attained because various combinations of machines can be used—for example, cope and drag on set of stripping machines; cope on stripper drag on rollover, or both cope and drag on rollover. With varying production the number of molding machines used can be adjusted even to the extent of completely shutting down one unit without interferring with operations of the other. These units also have been designed to facilitate pattern changes with very little interruption in overall production. In fact an average of four pattern changes a day are made on each set of machines.

Fig. 9 shows a representative group of castings produced on No. 9 unit. This unit was designed primarily to produce castings in snap flasks too large for one man to handle alone. The castings generally consist of manifolds, water pipe and thin-section housings. They range in weight from 8 to 75 lb. and vary in lot sizes from 1 to 600 pieces a day from a given pattern.

No. 9 unit consists of a powered mold conveyor of 62 cars with 44-in. centers and a maximum conveyor speed of seven cars per minute; roller conveyors to carry the molds from the ramming unit through the coring station to the mold conveyor, and an automatically controlled sand system. Two 12-ft power-driven turntables, each carrying six individual pedestals, bring the flask and patterns underneath the stationary sandslinger where the molds are rammed. Patterns can be either matchplate or cope and drag. When matchplates are used the completely assembled flask and pattern are placed on a pedestal with the drag side up. After the drags are rammed on the first revolution of the turntable they are removed and placed on a bottom board on the drag roller conveyor. Another drag half of the flask is assembled with the pattern and the cope, and placed on the pedestal with the cope half up. On the next revolution of the turntable the cope halves are rammed, lifted off and placed on the cope roller conveyor.

If a cope and drag pattern is used, one-half of the pattern is placed on each pedestal with the corresponding half of the flask. In the case of matchplate patterns, therefore, two revolutions of the turntable are required to produce one complete mold, whereas in the case of cope and drag pattern a complete mold is made with each revolution.

Molds are cored on the roller conveyor and closed, the empty flask is returned by means of another roller conveyor to the ramming turntable. The complete mold is placed on the mold conveyor by an air hoist, after which the jackets and weights are positioned by an electric hoist. Molds are then poured, after which they travel to an automatic shakeout and the bottom boards remaining on the conveyor are returned to the molding station. The flask sizes



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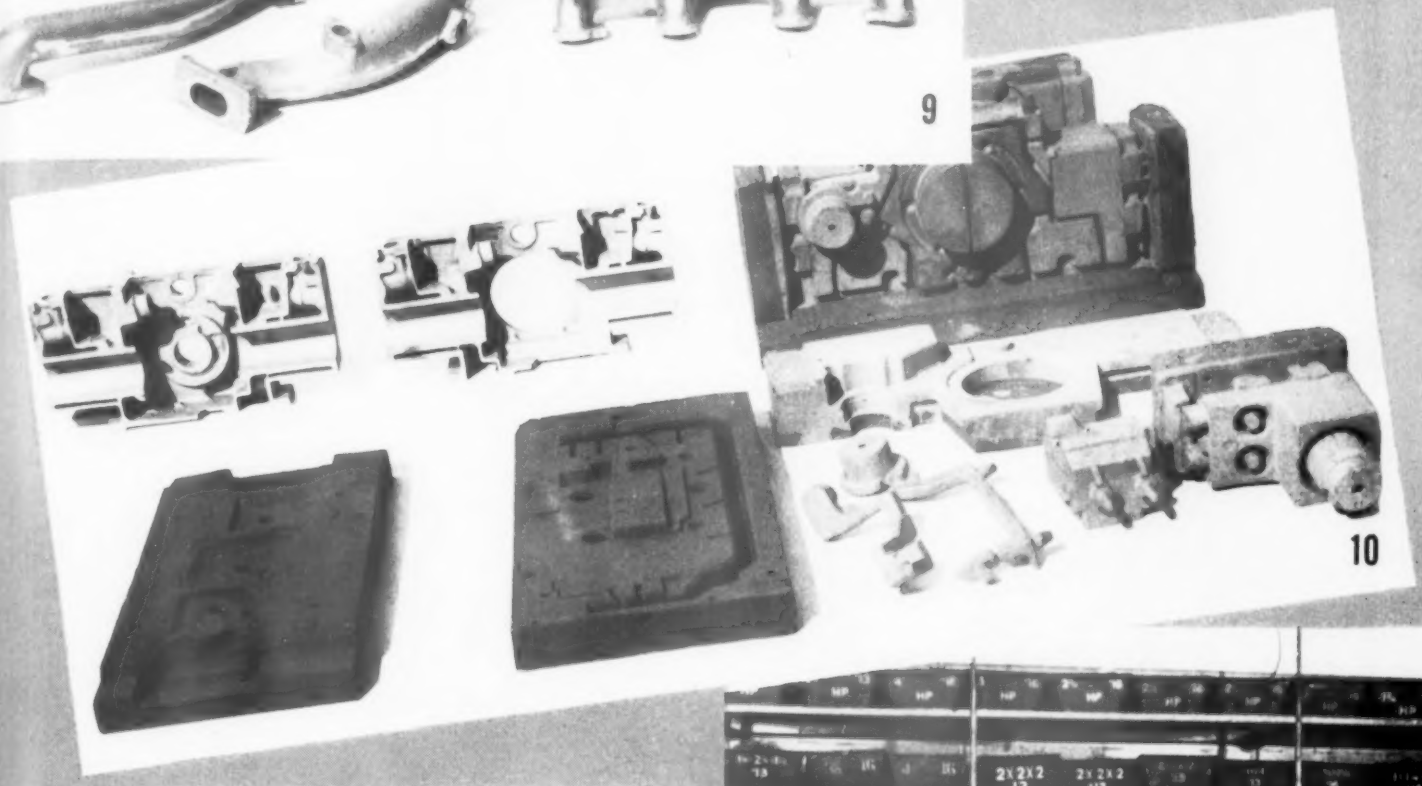

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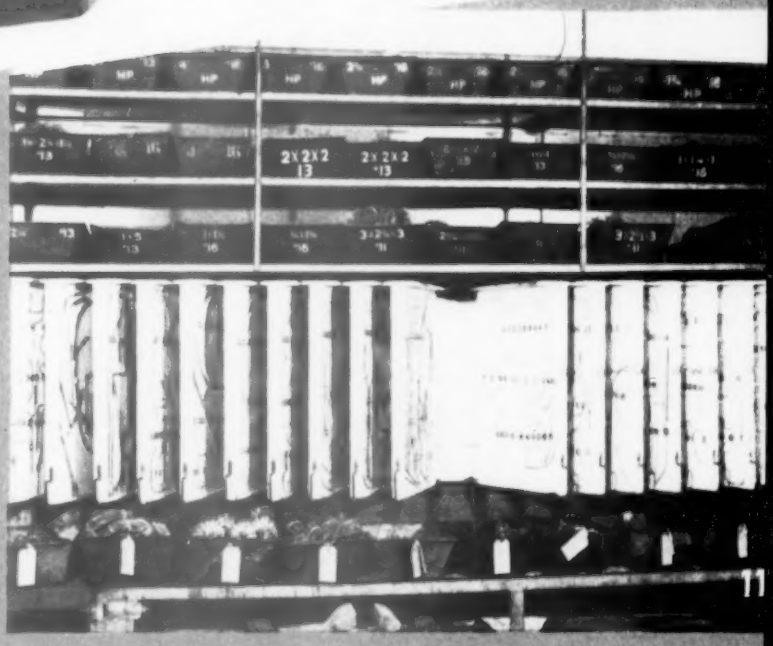


11

DAILY FOUNDRY SCHEDULE

UNIT No. 7 — DATE MAY 2, 1949 — UNIT No. 8

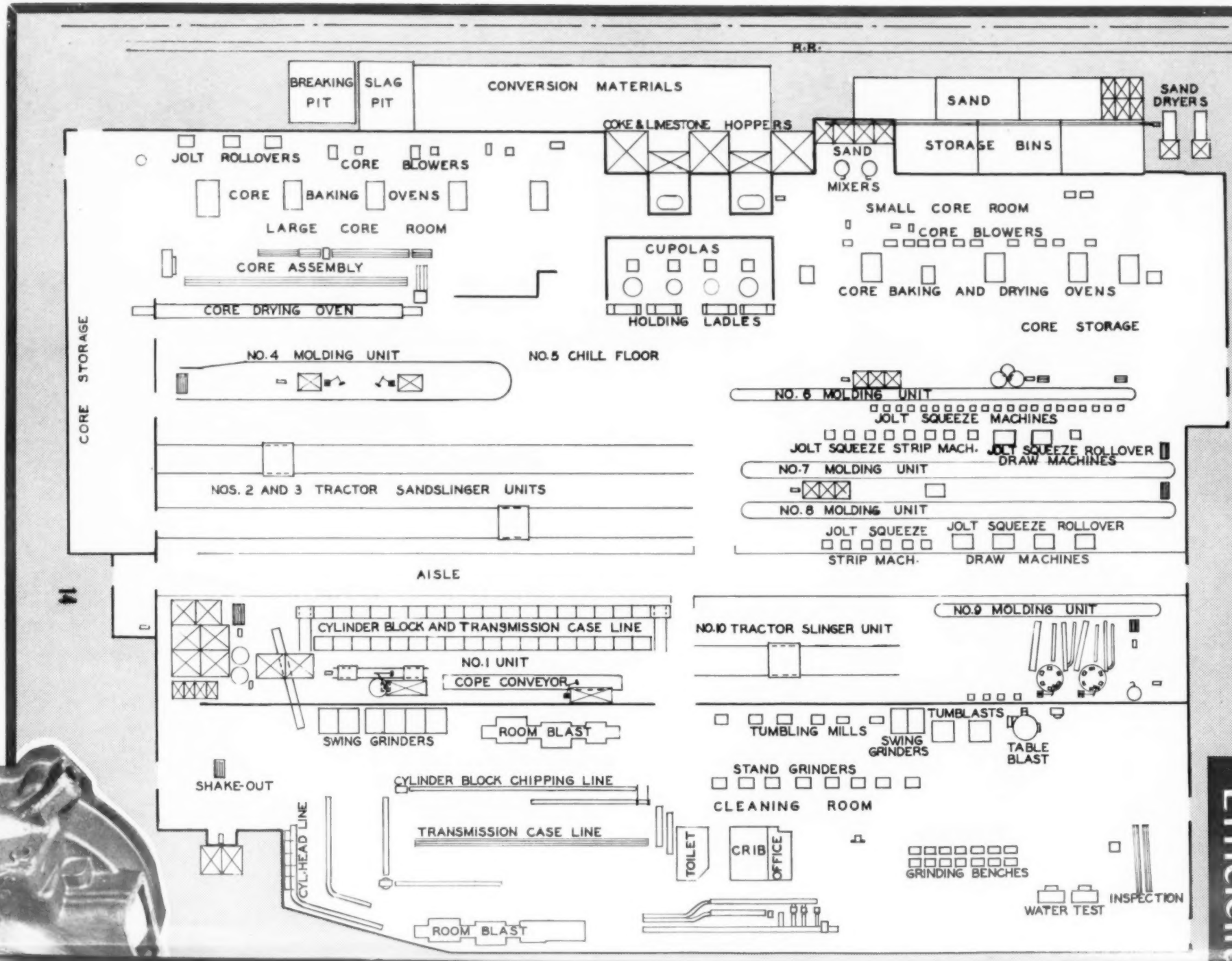
MACH	PART No	PC'S	SCH.	FLASK	SX	MACH	PART No	PC'S	SCH.	FLASK	SX
182	5F8933-C L688-C	320 96	7-8 5-7	3753A 3806	2" 3"	217	1F9708-C 361A-C	170 40	7 6	3A714 1C126	2" 3"
217	4F9319-C 4F9735-C 7F1369-C	40 132 90	7-8 5A 7	2A130 1A1045 1A30A	3" 2" 2"	217	1F9708 361A				
217	4F9319 4F9735 7F1369					217	124896-3 5F2112-3 5F2118-3	140 ? 25	6-? 7 7-8	W4 & T56 W4 & T56 W4 & T56	2" 6" 2"
182	5F8932 L688					217	124896 5F2112 5F2118				
163	6F8276-C 6F8774-C	130 72	7 7	FX785015 FX785015	4" 11"	182	4F7413-C 6F2567-C	100 112	7-8 5	FDF486 FDF486	6" 9"
163	6F8276 6F8774					182	4F7413 6F2567				
142	4F8592-C 5F8219-C	270 144	7 7	3A30A 3A30A	2" 4"	182	5F6197-C L610-C	162 36	7 3-		
142	4F8592 5F8219					182	5F6197 L610				
182	7F7265-C 5F2718-S	90 156	7 6	1A8093 4103#2	8" 6"	142	5F7308-C 2A1027-C	480 480	7 3-		
182	7F7265 5F2718					142	5F7308 2A1027				
182	Run Loose Work and Samples										

13

FOUNDRY BURDEN RECAP

UNIT	CODE	EFFICIENCY	BURDEN HRS.	EFFICIENCY LOSS	TOTAL HRS.	AVAIL. HRS. 5 DAY WEEK	MONTHS WORK	REMARKS
#1	1	93%	303	23	326	305	1.07	2 Shifts
#2-3-10	2	97%	553	17	570	588	.97	28 Hours Per Day
#4	3	97%	292	9	301	315	.96	2 Shifts
#5	4	99%	622	6	628	672	.93	32 Hours Per Day
#6	5	98%	2853	58	2911	2760	1.05	15 Men 1st Shift 16 Days 5 Men 2nd Shift 21 Days
#7 & 8	6	95%	1880	99	1979	2120	.93	10 Crews 1st Shift 16 Days 5 Crews 2nd Shift 21 Days
#9	7	96%	325	13	338	296	1.14	1 Table 1st Shift 16 Days 1 Table 2nd Shift 21 Days
LINERS	8	95%	284	15	299	280	1.07	5 - 8 Hour Shifts 7 Drag 12 Cope
DRY SAND	9	96%	627	26	653	630	1.04	4 Men 7.5 Hours Per Day

12



Efficient So

nt Scheduling

used on this unit range from 10 x 27-in. with 6-in. cope and 4-in drag, to 15 x 40-in. with 8-in. cope and 7-in. drag. Here again stress is laid on the ease of pattern changes. Jobs can be changed with no loss in production, for a new job can be assembled and placed on the pedestal just as rapidly as one which has been running.

Either one or both turntables can be used depending upon production requirements, and the operation of one in no way interferes with the operation of the other. This in effect provides two molding units with a common mold conveyor and sand system, thereby providing considerable flexibility. Quite a few jobs which normally run on this unit can also be made on the jolt-squeeze snap flask unit or on the cope and drag unit, and the same thing is possible in reverse. Before any given day's run, the supervisor sets the speed of the turntable according to the jobs which are to be produced that day. It is planned to run jobs together whose time-study rates coincide as nearly as possible.

The foregoing discussion of the layout of the different molding units has stressed the variety of jobs run, with special emphasis on the fact that many jobs are designed to be run on several different units when the burden on a given unit necessitates such a move. In the corerooms, naturally, there is still greater variety because most molds use several cores. In fact, over the years the design of castings has changed to such an extent that, on an average, 1½ lb of cores are required for every pound of good castings produced.

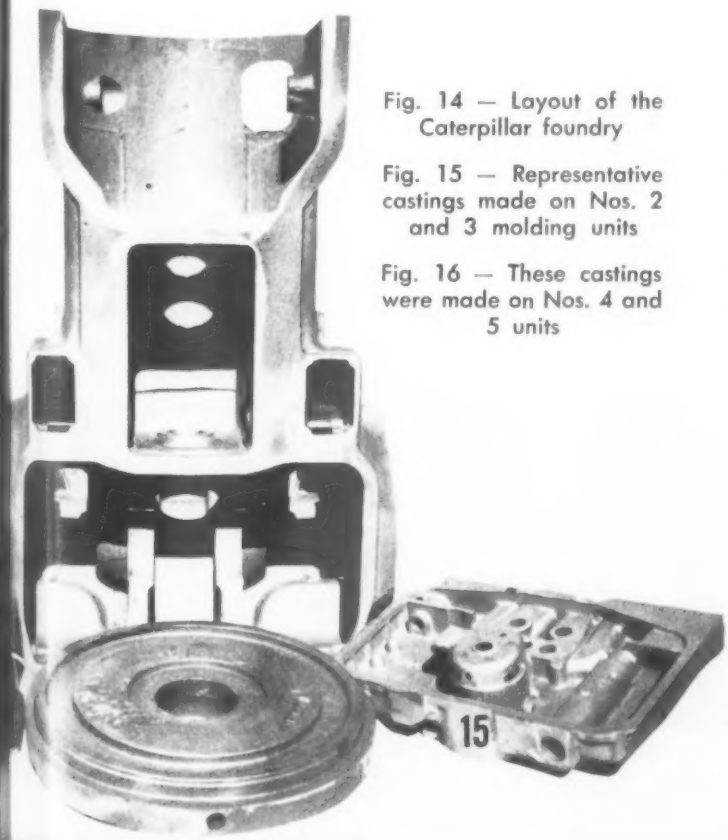


Fig. 14 — Layout of the Caterpillar foundry

Fig. 15 — Representative castings made on Nos. 2 and 3 molding units

Fig. 16 — These castings were made on Nos. 4 and 5 units

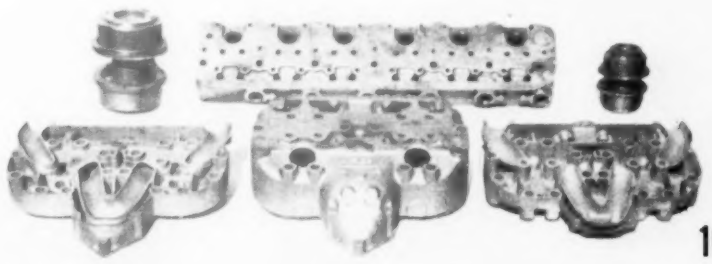
Coreroom facilities are divided into two general parts. The small coreroom is equipped to make cores from the smallest pin cores to diesel cylinder head jackets. The majority of cores are made on blowers, with the exeception of short run jobs, experimental or research castings, which are made by hand on a bench. There are 13 core blowers in this coreroom with sand magazines ranging from 6 x 10-in. to 19 x 24-in. Each blower is equipped with a draw. Core racks are placed at each blower or bench by overhead cranes. When each rack is filled this same crane is used to pick up the rack and deliver it to the roller conveyor immediately in front of each baking oven.

There are three baking ovens and four drying ovens in this coreroom, all of the vertical type with automatic temperature control, fired by either gas or oil. After cores are baked they are taken from the discharge side of the oven on transfer cars to a set of roller conveyors in front of the core dipping stations where cores are removed from racks, cleaned, assembled or pasted if required, dipped and then placed in drying ovens. Core driers are returned to the proper core making stations by means of hand trucks. In as many cases as possible coreboxes are designed so that they may be run on either one of several different blowers, on small hand rollover machines or on the benches, when the burden necessitates this to alleviate the schedule. Of course, it is also true that many coreboxes must run on a certain size machine.

In the large coreroom cores ranging in size up to 885 lb each are made. In addition to the various size blowers ranging in magazine size from 15 x 38-in. to 21 x 43-in., and the benches, three large jolt rollover draw machines are provided to make those cores too large for a blower. This coreroom is equipped with five vertical ovens of the same type as those described in the small coreroom, except larger and slower in baking time cycle. After assembly and dipping, the cores pass through a horizontal type drying oven to a core storage room where they are inspected and made ready for delivery to the various molding units.

A roller conveyor unit adjacent to the large drying oven is provided to produce several different sizes of a 2-cylinder opposed gasoline starting engine casting shown in Fig. 10. Because of the complexity and accuracy required in this casting it is made completely in dry sand cores. The cores are assembled on slabs and held together by a steel frame with suitable clamping arrangement.

Wires and rods used in (*Please turn to page* 209)



A SIMPLE FRACTURE TEST FOR...

MELT QUALITY of Bronze Castings

ABSTRACT

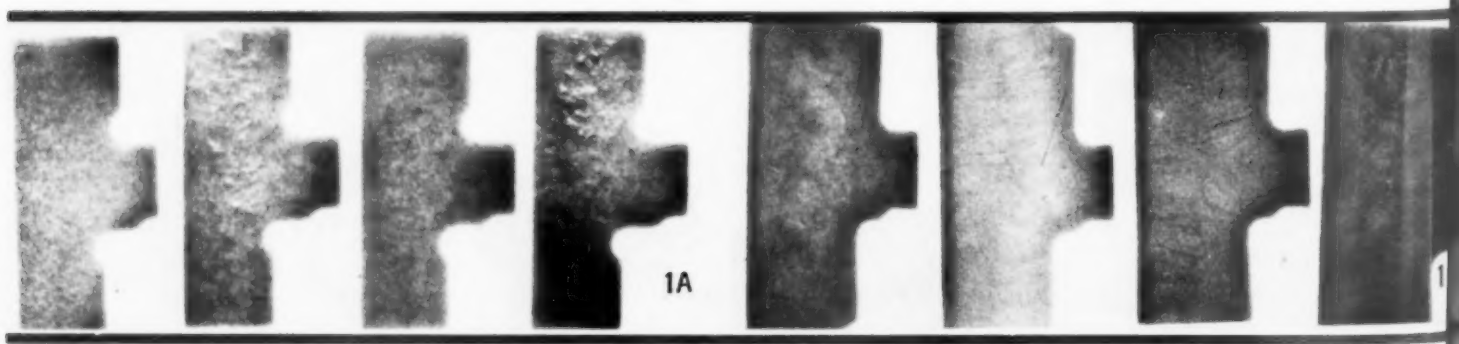
Bronze castings for pressure service are very difficult to produce dependably sound; porosity due to shrinkage and/or gas separation during solidification is the prime cause of unsoundness. Test bars, as currently used, never reflect the properties of castings and are not satisfactory criteria of melt quality. A simple test piece is described which will determine if unsoundness is caused by (1) shrinkage, (2) improper melt quality, or (3) gas pickup from wet or unsatisfactory molds. Visual examination of a fractured V-block will determine the above uniquely; a more critical examination is transverse x-ray of a thin slab cut from the test casting. Zyglo tests on the thin slab or pressure tests would also be suitable criteria of soundness.

BRONZE castings are used for ornamental purposes, for structural units, to contain liquids or gases under greater or less than atmospheric pressure, and for services which are a combination of these.

Castings used for their ornamental value require optimum surface finish and excellent reproduction of detail; physical properties and internal soundness are of minor importance. Castings used in structural applications require certain minimum physical properties to meet the design requirements. Safety factors are used in the design of these parts to take into account the possible occurrence of areas of small voids. There is adequate proof that uniformly distributed porosity of the order of 1 to 3 per cent of the volume of the casting has sufficiently small effect on the strength of the part as not to materially affect service performance in structural applications.

For pressure service, any voids which will allow passage of liquid or gas through the metal wall cannot be tolerated. The incidence of porosity in bronze pressure castings is unusually high; the dense "skin" regions adjacent to the mold wall in the as-cast condition are usually removed in machining the casting to finished dimensions. Salvage of leaky castings by welding, impregnation or other means has proved to be very difficult, expensive, and often impossible. Accordingly, it is imperative that the manufacture of *sound* bronze castings becomes the rule rather than the exception.

The treatment of shrinkage in castings, per se, has been reasonably well rationalized in recent years; if adequate feeding were all that is required for attaining soundness in bronze castings, there would seem to be no need for "leakers." It has been shown that the most important quantity in preventing shrinkage is controlled directional solidification; this simply means *an arrangement of temperature gradients within a*



By JAMES O'KEEFFE JR.
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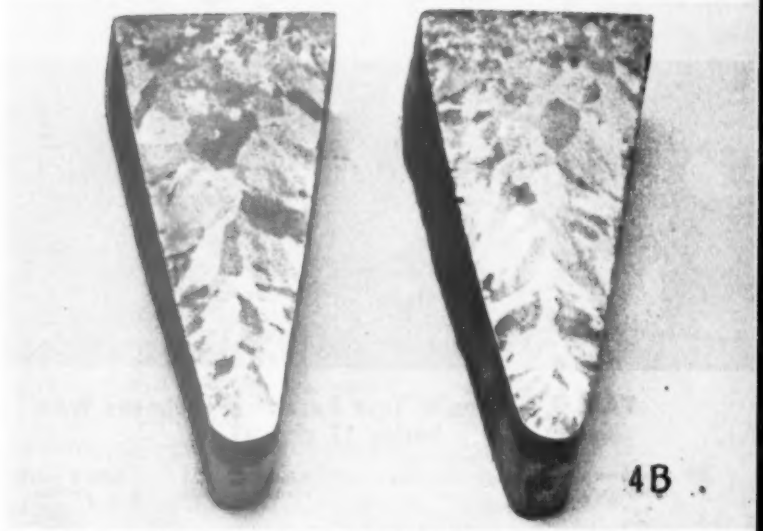
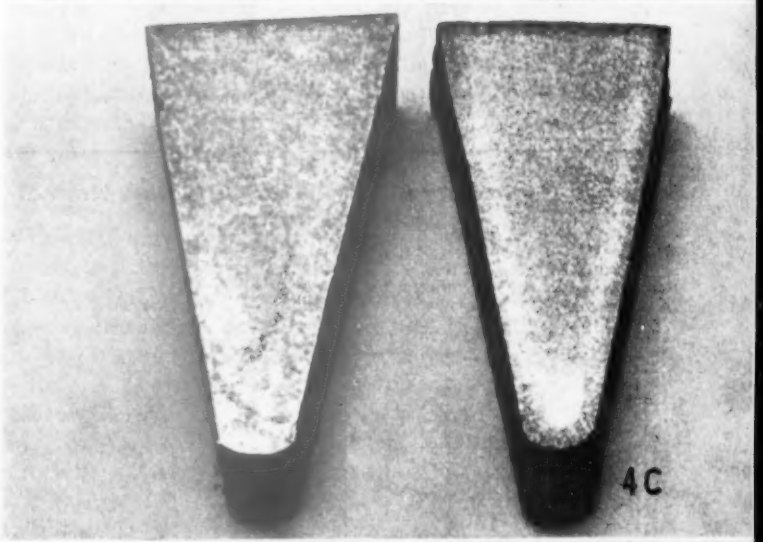
Fig. 1—Radiograph contact print of ⅛-in.-thick sections removed at quadrants from two 4-in. ID bushings. Porosity indicated in *A*, sound metal in *B*

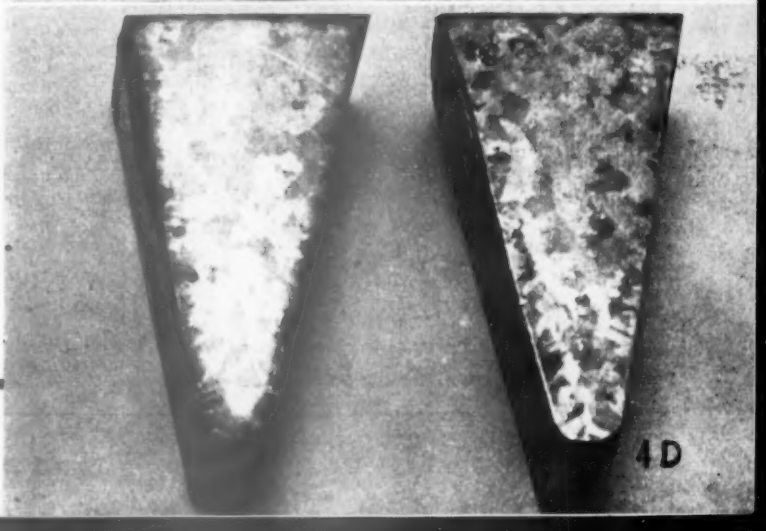
Fig. 2—Dense skin and porous interior of specimen MB, left, indicates poor quality melt. Uniformly sound specimen M21, right, was cast from high-quality melt. These are ⅛-in. thick transverse sections from test castings illustrated in Fig. 6

Fig. 3—Specimen 2S3, left, poured with insulated riser is radiographically sound. Specimen 1S3, right, with riser formed in sand has porous area at top. Both castings poured from same ladle

Fig. 4—View *A* shows sound sections from two specimens poured from high quality metal. View *B* is of two test pieces made with sand risers. Sections shown at *C* and *D* were taken from castings poured with insulating risers, and the structures are typical of low quality heats







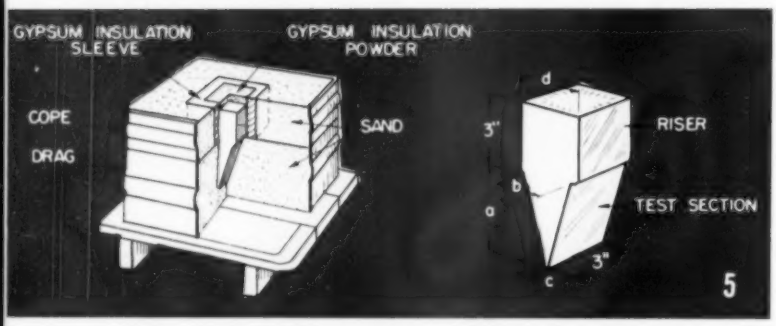


Fig. 5—Molding method and specimen dimensions for wedged casting to determine melt quality

DIMENSIONS OF SPECIMENS, INCHES

Dimension	Specimen Number Q1	Q2	Q3	R1	R2	R3	S1	S2	S3	T1	T2	T3
a	2	2	2	3	3	3	4	4	4	6	6	6
b	½	1	1½	½	1	1½	½	1	1½	1	2	3
c	¼	¼	¼	¼	¼	¼	¼	¼	¼	⅞	⅞	⅞
d	1½	2	2½	1½	2	2½	1½	2	2½	2	3	4

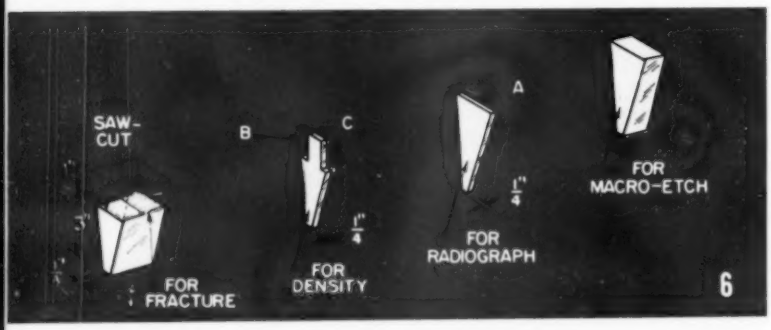


Fig. 6—Sections of test castings used for tests

TABLE I—Tensile Test Results, Specimens from Series 1T and 2T

Specimen Number	Ultimate Tensile Strength, psi	Elongation in 2 Inches, per cent	Area Reduction, per cent
1T1	17,750	2.9	2.6
1T2	18,750	3.3	8.9
1T3	18,750	8.1	5.0
2T1	41,000	46.8	27.8
2T2	39,250	51.9	37.2
2T3	36,750	34.8	35.0

A.S.T.M. Specification B143-46T requires: Ultimate tensile strength 40,000 psi, elongation in 2 inches 20 per cent, yield strength 18,000 psi.

TABLE II—Density of Test Specimens from Normal Melting Practice

Specimen Number	Density* g per cc	Per cent Voids**	Pouring Temp, °F	Remarks
		SERIES A		
MB	8.14	8.70	2150	
M1	8.47	5.10	2150	
M2	8.77	1.68	2150	
M3	8.75	1.90	2100	
M4	8.69	2.58	2020	
M5	8.80	1.34	2050	
M6	8.68	2.69	2160	
M7	8.66	2.90	2120	
M8	8.71	2.35	2260	
M9	8.72	2.24	2100	
M10	8.62	3.35	2100	
M11	8.85	0.78	2050	
M12	8.75	1.90	2000	
M13	8.69	2.58	2150	First of ladle } same heat.
M14	8.73	2.13	2050	Last of ladle }
M15	8.67	2.79	2160	First of ladle } same heat.
M16	8.72	2.24	2100	Last of ladle }
M17	8.67	2.79		At furnace }
M18	8.74	2.02	2100	At skimming station } same
M19	8.79	1.45		First mold } heat.
M20	8.81	1.23		Last mold }
		SERIES B		
M21	8.80	1.34		First of ladle } same heat.
M22	8.79	1.45		Last of ladle }
M23	8.76	1.79		First of ladle } same heat.
M24	8.81	1.23		Last of ladle }
M25	8.70	2.46		First of ladle } same heat.
M26	8.78	1.57		Last of ladle }
M27	8.72	2.24		First of ladle } same heat.
M28	8.78	1.57		Last of ladle }
M29	8.84	0.89		First of ladle } same heat.
M30	8.80	1.34		Last of ladle }
M31	8.87	0.56		First of ladle } same heat.
M32	8.80	1.34		Last of ladle }

* Density of specimen C, as shown in Fig. 6.
** Theoretical density of 8.92 g per cc is taken from results reported by Hesse and Basis, *Journal*, American Society of Naval Engineers, 55: 49, 1943.

solidifying casting so that those parts most remote from the riser freeze first, and that solidification take place directionally toward the riser without premature freezing of intervening sections.

To attain proper temperature gradients, it is necessary to (1) design the casting so that it can be adequately fed, or (2) resort to the use of chills, insulating pads or special risers. These simple expedients are not widely used, and many unsound bronze castings are a direct result of this neglect. Steel foundrymen have long known that they must apply the established laws of controlled directional solidification in order to make castings sound enough to meet competition from forgings, weldments, etc. It is rarely appreciated that this principle is as important in bronze castings as in steel castings.

There is good evidence that more adequate feeding is only one aspect in making sound pressure bronze castings. The role of gases in causing porosity is incompletely understood by foundrymen, or indeed by anyone; normally gas and shrinkage porosity are blamed alternately and indiscriminately for casting failures. It is essential to isolate and recognize these causes of porosity and to understand when and why each is operating. This can only be done if test pieces are used which satisfy the laws of solidification and will be sound if satisfactory metal is used to make them. Most test bars used today do not satisfy this condition.

Fig. 1 is a reproduction of the transverse x-rays from thin slabs taken at quadrants from a cylindrical casting which leaked under pressure. The x-rays showed clearly why the casting leaked—it was porous. This porosity could result from shrinkage, gas separation or from an unhappy combination of both. At this point it is impossible to assess the trouble accurately. Fig. 1*B* is included to show sound metal from a similar casting which did not leak—this casting was sound because the metal was melted under carefully controlled conditions from selected materials. Since the same molding and gating and risering techniques were used in each instance, it can be assumed that the porous castings were due to gas separation.

It is the purpose of this paper:

(1) To describe a simple shop test which can be used as a criterion of melt quality and which will dependably predict gassy and satisfactory melts.

(2) To show that bronze castings poured from gassy metal cannot be fed sound regardless of how carefully known laws of solidification are applied.

(3) To point out that an unsound test piece of the type described in this report is a dependable indication that the metal from which it was poured will yield porous castings, and that the test can be used to segregate doubtful work even before castings are machined and pressure tested.

(4) To call attention to the satisfactoriness of the fracture test as a criterion (*Please turn to page* 234)

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SOLIDIFICATION of Molten Metal

A resume of the mechanism of metal solidification and its effect on the properties and design of castings are discussed here. This article comprises a chapter from "Co-ordinating Casting Design with Production," a paper submitted by the author to Purdue University in partial fulfillment of the requirements for the degree of Metallurgical Engineer

A NEED of those who use the casting method, principally the sand casting process, is more basic information on its various phases. At least one such project is being carried on by Dr. Victor Paschkis, technical director of heat and mass flow analyzer laboratories, Department of Mechanical Engineering, Columbia University, New York, under the direction of a committee of the American Foundrymen's Society. When the project was outlined, it was thought desirable to determine the values and effects of the following thermal properties as related to the solidification of metals: (a) As related to the mold, (1) specific heat, (2) density, and (3) thermal conductivity; (b) as related to the metal, (1) thermal conductivity, (2) density, (3) heat of fusion, and (4) temperature range of fusion.

As a result of the tests thus far conducted, it has been established that "(a) pouring temperature (superheat) has a marked influence on beginning and end of solidification, (b) the solidification range influences the beginning and end of solidification an appreciable amount, (c) specific heat is the determining factor as far as times for beginning of freeze are concerned but has less influence on times for end of freeze, (d) heat of fusion has a relatively small influence on start of freeze and a large influence on end of freeze, (e) of the three thermal properties, the conductivity has the smallest influence on solidification times."

As to the investigation of mold properties, the work done thus far also is outlined in the reports noted. This type of work is slow and costly but the writer feels that in the end, it will supply a basis for more exact knowledge of the interrelation of mold and metal properties in the solidification of castings, practically regardless of composition of mold material.

Beginning of Solidification—When metal first enters a mold cavity, it is chilled by the mold surface. Whether or not solidification begins as soon as the metal enters the cavity or does not begin until the cavity is filled apparently depends upon the rate at which the metal enters the cavity. E. V. Ronceray[1] of France over 20 years ago poured a large casting of gray iron without the use of any risers by use of a very slow pouring rate and produced a solid casting. The same practice has been tried experimentally by Frank J. Dost[2], Sterling Foundry Co., Wellington, O.

In either case, it is well known that neuclei are necessary to begin solidification and that the greater the number of neuclei the more rapid solidification and the smaller the initial grain size. Since tests[3, 4] in which the mold is poured and allowed to set for a short length of time and the unsolidified metal then poured from the mold show that the metal solidifies from the mold-metal interface toward the center of the section, the neuclei must be formed initially at this point. This apparently is further evidence that a temperature difference is essential to the formation of neuclei.

The mechanism of the formation of dendrites from the original neuclei is described in many texts and will not be repeated here. However, the influence of dendrite formation on the solidity of a casting section and on the feeding mechanism is not so generally known.

Theoretically, provided sufficient time is allowed, as the metal solidifies, the portion solidified in each increment of temperature drop changes composition until the final portion solidifies with a eutectic composition, the ultimate composition of the mass tending toward uniformity due to diffusion. The eutectic composition is also the one of lowest solidification temperature. There also is a change in volume during solidification. This change is compensated for by the use of risers on castings. Whether or not these reservoirs of liquid metal can function properly depends upon several factors.

While the metal in the mold cavity is in the first stages of solidification from the mold-metal interface toward the center line of the section, there is little or no difficulty in compensating the volume change by the liquid metal in the riser. However, as the dendrites continue to reach out toward the center line, there remains less and less (*Please turn to page* 222)

Flasks and R

How to calculate the lifting force of molten metal on the cope and cores is described in this second and concluding article concerning flasks and rigging in the steel foundry

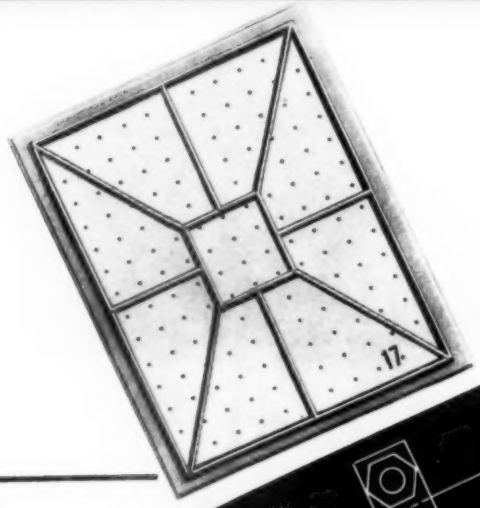

Fig. 17—Large size cast iron core plates are reinforced and perforated. (Courtesy Diamond Clamp & Flask Co., Richmond, Ind.)

Fig. 18 — Sketch showing double binder using three tie rods

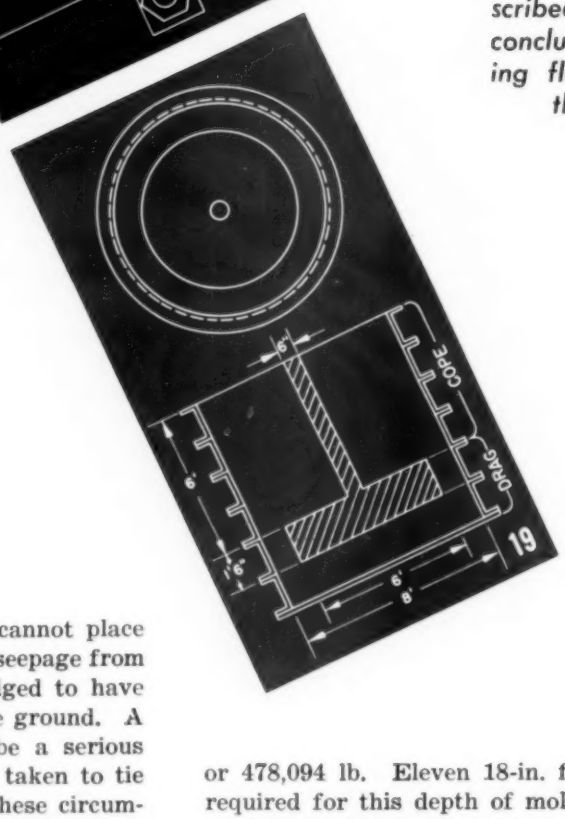

Fig. 19—Cross sectional view of mold containing large disk with integral shaft

SOME foundries making big castings cannot place their flasks in pits, because of water seepage from a nearby river or lake, and are obliged to have the greater part of their big molds above ground. A run-out in such a shop will naturally be a serious matter, and extra precautions should be taken to tie the molds together adequately. Under these circumstances very low factors of safety should be used in calculating the loads to be applied to flasks, binders, tie-rods and bolts.

It is not safe to estimate the size and number of bolts or tie-rods required to hold a deep job of this sort, by using the total pressure on the side of the mold, since such a calculation gives only the average stress on the bolts. Figuring in this way will result in the use of bolts heavier than necessary for the upper part of the mold and too light to safely resist the stresses near the bottom.

For instance, the total area of one side of the casting shown in Fig. 15 (January issue) is 126 sq ft, or 18,144 sq in. The average depth of metal in the mold is 8½ ft and the pressure at this depth is 26.35 psi. The total pressure on the mold then is 18,144 × 26.35, or 478,094 lb. Eleven 18-in. flask sections would be required for this depth of mold, the top 6 in. of the head being taken care of by a small section of flask set on top of the mold and suitably tied down. There would be 176 bolts in the 11 sections to resist the load, each of which therefore would sustain a load of 478,094 ÷ 176 or 2716 lb. If ⅞-in. diam bolts, each with a cross-sectional area of 0.4197 sq in. were used, the stress would be 2716 ÷ 0.4197, or 6471 psi. This is only a little over half the load imposed upon the bolts near the bottom of the mold and is far greater than that to which the uppermost ones would be subjected.

Often a job such as this would be rammed up "on the flat," using a two-piece flask, and stood on end for pouring. If it is decided to reinforce the mold with binders and tie-rods, it is necessary to figure the size of rods required to resist the maximum

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Rigging for Steel Castings

stresses at the bottom of the mold, rather than the dimensions of bolts required to sustain the average pressures. In the case under discussion, for instance, the total load on the long side of the mold is 478,094 lb, and if it is decided to use binders at four levels, the eight tie-rods called for would sustain an average stress of 478,094 ÷ 8, or 59,762 lb each. If 10,000 psi is taken as the safe load in the rods, the latter would have to be 59,762 ÷ 10,000 or 5.98 sq in. in cross section. This corresponds to 3⅛-in. diam bolts.

The bolts at the bottom of the mold, however, would have to sustain the load due to one-fourth the height of the casting, or 4½ ft with a width of 8 ft. The pressure-producing area therefore is 96 x 51 in., or 4896 sq in. Average depth of this area below the surface of the liquid steel is 14.875 ft, and the pressure at this depth is 14.875 × 3.1, or 46.11 psi. The total load on this portion of the mold, then, is 4896 × 46.11, or 225,755 lb. If this load were to be sustained by only two tie-rods, each would carry 112,877 lb and at the allowable fiber stress, 10,000 psi, should have a cross-sectional area of 11.29 sq in. This calls for tie-rods nearly 4¼ in. in diam, whereas if the average load on the rods in the mold is considered, 3⅛ in. is the estimated size.

Even if two rods are used at each end of the binder, a rod 3 in. in diam is required, and if a total of six rods is used, with a double binder as illustrated in Fig. 18, the rods should be 2½ in. in diam. The loads to be sustained by each of the four sets of binders and tie rods in the case being considered are shown in the accompanying table, the sets being numbered from the bottom up.

LOADS SUSTAINED BY BINDERS AND TIE-RODS

Set	Depth Below Surface, ft	Pressure, psi	Area, sq in.	Total load, lb
1	14.875	46.11	4896	225,755
2	10.625	32.9375	4896	161,262
3	6.375	19.7625	4896	96,757
4	2.125	6.5875	4896	32,252

The two uppermost tie-rods, to sustain the same safe load, 10,000 psi, would need cross-sectional areas of 16,126 divided by 10,000 or 1.61 sq in., and thus need be only 1 11/16 in. in diam.

If this mold must be set entirely above ground, it would be advisable to use a number of ⅞-in. diam bolts to tie the two halves of the mold together through the flanges of the flask, and thus reduce the size of the tie rods required to strengthen the mold.

Another factor to be considered in estimating the strength of binders and tie rods required for a mold, is the lifting force on a large horizontal surface of sand, which is acted upon by fluid steel at a considerable depth below its surface. Thus the author once knew of a bad "run-out" in pouring a large flat disk with an integral shaft, such as is shown in the accompanying Fig. 19. The man who closed this mold used weights to hold down the cope, and supposed that they needed only to equal or somewhat exceed the weight of the central shaft, 6 in. in diam. and 6 ft long, which weighed 577 lb. Naturally, when the mold was poured, the cope came up off the drag and the steel ran out on all sides.

The lifting force involved in this case is obtained by multiplying the area of the top surface of the disk by the pressure in psi at a depth of 6 ft. Since the area of the 72-in. diam disk is 4071.5 sq in., and the area of the 6-in. diam shaft is 28.3 sq in., the difference in area in contact with the cope is 4043.2 sq in. The pressure at a depth of 6 ft is 6 x 3.1, or 18.6 psi, so that the lifting force on the cope sand is 4043.2 x 18.6, or 75,200 lb.

The cope contains about 300 cu ft of sand weighing some 30,000 lb, and weighs perhaps 20,000 lb, if it is made up of four circular pieces 18-in. deep, and of the cross section shown in Fig. 19. The net lifting force, therefore, is the difference between the total force, 75,200 lb and the weight of flask and sand, or 25,200 lb. If weights were to be used to hold the cope down, about 12.6 tons would have been required, instead of the half ton or so actually used. If the cope had been secured by two binders and four tie-rods, 1 1/16-in. diam, they would have been stressed to approximately 10,000 psi and would have been amply strong to resist the ferrostatic lifting force.

In pouring such a mold as this, even when the cope flask is strongly tied down with binders and tie rods, the sand in the cope will sometimes be forced up over part or all of the area of the casting, because the friction between the sand and the cope bars is insufficient to hold it in place. To prevent the sand from rising in this way, and producing a "swelled" casting, which may be as much as an inch or so too thick, it is often (*Please turn to page* 135)

Questions AND

Producing a Hard Sand Match

Q.—We are using plaster and other composition type matchplates, but they don't stand up when used on a bumper. The flask is 6 x 9 ft. Our foreman claims that a certain type of hard sand match is used in European and some American foundries. Unfortunately, he is not familiar with the composition which makes the sand as hard as concrete.

A.—Hard sand matches, as the term usually is applied to sand bonded with linseed oil, are used for hand molding and for use on squeezer molding machines. They will not stand up for any length of time on a bumper. The best material for this purpose is a material mixed with water and poured as a liquid. It solidifies practically as hard as stone. Names and addresses of the suppliers appear regularly in the advertising section of THE FOUNDRY.

The material referred to by your foreman probably is a cement bonded sand first developed in France and now used in several plants in this country for making molds and cores. In the process the molds and cores are made in a cement-bonded sand and air dried. Resulting molds and cores are rigid and as hard as stone and make perfect castings. We have no personal knowledge of the material being used for matchplates, and we do not know how it would stand up on a jar-ram machine, especially in a flask 6 x 9 ft, but we are inclined to the opinion it might stand up for a reasonable period.

Dross Caused by Adding Brass

Q.—We would like to have information on the proper procedure for melting copper. Our difficulty seems to be in having a metal and dross collecting inside the crucible in a semi-solid form while metal on the inside of that collection is quite fluid. We use electrolytic copper ingots and add about 15 per cent yellow brass scrap.

A.—It seems rather odd to us that, after purchasing a high-grade material like electrolytic ingot, you would contaminate it by addition of scrap material of unknown analysis. If you want to eliminate usual trouble from gases by inclusion of around 1 to 2 per cent zinc, you will be further ahead by adding the necessary amount of a good grade of slab zinc just a few minutes before pulling the crucible from the furnace. Assume your description of the dross collecting inside the crucible refers to the top of the bath around the edges, and it probably is mainly zinc oxide plus lead and perhaps aluminum oxides from the yellow brass which is a liability instead of an asset.

Since copper tends to pick up gases during melting, it usually is covered with charcoal, but the charcoal must be absolutely dry, or it will put in more gas than it will keep out. Melting should be as fast as possible since the less the time in the furnace, the less chance it has for picking up gases. Since you are adding yellow brass scrap, the castings evidently do not require high conductivity, and use of zinc as previously mentioned will aid in producing solid castings. If high conductivity is desired, the metal will have to be degasified with lithium, copper boride, etc., which can be purchased from various sources. Other means of preventing pickup up of gases during melting include the placement of small amounts of manganese ore or marble chips in the bottom of the crucible.

Mold the Castings Face Down

Q.—We make a considerable number of household irons which are heated with charcoal. The inside chamber is formed with a dry sand core which rests in a print in the drag. The castings are molded by hand with two patterns side by side in a flask. The castings are not as clean and smooth as we should like to have them, especially on the working face. We also have trouble with cracked castings. We shall appreciate your opinion on the best type of molding machine for making these castings. Also, where and by whom is this type of machine made?

A.—Unfortunately, we are not personally familiar with the foundry practice involved in the production of household irons in which charcoal is the heating medium. We have seen specimens in museums and private antique collections, but never have studied or examined them closely. With electric current available nearly every place in city, town and country, practically all the household irons in this country are electrically heated.

Volume of production will determine whether you are justified in changing from the present method of hand molding, two patterns in a flask, and dry sand cores, to mechanical molding with either green or dry sand cores. Incidentally, your present dry sand cores are too hard. They crack the castings. Theoretically, the present method does not conform to good foundry practice. The face of the casting, later to be ground and polished, is on top against the face of the cope. Any stray, floating foreign material in the metal will remain in this area. If it cannot be removed by a light surface finish, the casting is a waster. Good foundry practice indicates that the casting face to be finished should be on the bottom of the mold.

We suggest you write the various molding machine

ANSWERS

manufacturers whose names and addresses are presented in every issue of THE FOUNDRY. Men in these organizations will be pleased to explain the capabilities of their machines with particular reference to the present problem.

Handling of High-lead Bronze

Q.—In the production of high-grade bronze castings containing 20 to 30 per cent lead is it desirable to pig the metal after the initial melting, and then remelt for the castings? To what temperature should the copper be raised before alloying the lead and tin? To what temperature should the metal be heated, and how long should it be held at that temperature before cooling for pouring? Is the quenching of sand castings after pouring resorted to for attaining finely dispersed lead? If so what medium is used?

A.—So far as we know, there is no necessity of melting down the raw materials for high-lead bearing bronze, ingotting and remelting, provided the exact compositions of the raw materials are known. If scrap of unknown composition is used, it is essential to ingot and analyze so that suitable adjustments may be made.

Since both lead and tin are low melting point alloys, they usually are added just prior to removing the crucible from the furnace for pouring. As the pouring temperature of the leaded bronzes will range from 1850 to 2200°F, depending upon the section thickness of the casting, the copper should be heated to approximately 150°F above that to allow for the addition of the cold tin and lead. The metal removal from the furnace should be from 50 to 100°F above the pouring temperature to allow for a temperature drop while skimming and carrying to the pouring station. Melting should be accomplished as rapidly as possible, and the molten metal removed from the furnace as soon as the desired temperature is reached. The longer the metal remains in the furnace, the more gas it can pick up.

So far as we know, the leaded bronzes are not chilled except by pouring into chill or metal molds. Castings poured in sand molds would have to be solid before they could be quenched, and by that time the condition of the lead could not be changed.

Make Solid Gray Iron Slugs

Q.—Our loss has been heavy on a cast iron slug $6\frac{1}{8}$ in. diam, and $8\frac{3}{4}$ in. long. The castings are molded and poured in a vertical position and the loss has been due to dirt and shrinkage on top of the castings. We allow $\frac{1}{2}$ to $\frac{3}{4}$-in. on the top to be machined off, but the shrinkage holes extend to a depth of $1\frac{1}{2}$ to 2 in. We have tried different styles of gates and risers, but without success. We use soda ash and a proprietary flux to clean the iron, soda ash in the cupola and flux in the reservoir ladle. We also cover the risers with an antipiping compound. We shall appreciate your advice on the proper procedure to produce clean, solid castings.

A.—Any of the gates and risers shown in the sketch which accompanied your recent inquiry should function satisfactorily. From the evidence submitted we are inclined to the opinion that the metal and method of melting and pouring are not responsible for the defective area on top of the casting. If the sand is too tight, or too wet or rammed too hard, the metal will not lie quietly, but will kick and boil with consequent production of a slushy compound of sand and iron which floats to the top. Some of the material may stick to the side wall of the mold. A possibility exists that the long gates are not made properly, with the result that loose sand is washed into the mold with the metal. You can determine this point by pouring a casting in a mold without a cope and noting the behavior of the metal as it rises in the mold.

With this feature remedied to your satisfaction, two alternative methods of pouring are available. It is not necessary to introduce the metal near the bottom of the mold either through a straight or a horn gate. Choice of a simple type of gate will depend to some extent on whether you are in position to machine the top, or if the customer wants the slug in the as-cast condition. In the first instance the metal may be poured directly into an open mold about 1 in. longer than the desired casting. The mold is filled to the top and then the metal is covered with black-

GANGWAY!

By J. A. PATTERSON

"No sooner do I sit down . . . ."

ing, charcoal, dry sand, ashes, or any other insulating material. In the second method the mold is covered with a dry sand core. A semispherical hollow in the upper side of the core is connected to the mold by a small opening about 1-in. diam.

Pouring Temperature Too High

Q.—We are sending you a piece cut from a bushing cast of the 80-10-10 mixture. The defect shown occurs at intervals in this class of castings, and we would like to have your opinion as to the probable cause.

A.—Specimen submitted for examination is taken from a 3-in. diam bushing with a cored bore 1½ in. in diam, and shows numerous small holes just under the surface on both exterior and interior surfaces. Appearance of the holes, which were discolored, led us to the opinion that they were due to mold and core gases. Fracturing the specimen revealed the structure to be full of discolored patches which indicate that the metal was poured at too high a temperature. That presumably is why you only have the trouble at intervals—your coremaking and molding practices serving satisfactorily when normal pouring temperatures are employed.

Molding Method Probable Cause

Q.—Cast iron bushings 5 in. ID, 6⅝ in. OD and 8 in. long appear to be clean and perfect when shaken out of the sand. In the machine shop the first cut discloses small and large holes, clear and bright without any sign of slag or other foreign material. Metal is melted in a cupola 30 in. inside the lining. The blower has a rated capacity of 1765 cfm at a pressure of 9 oz.

A.—Pin holes, porosity, shrinkage and other defects of the same general character may be traced either to the mold or the metal. In some instances where mold and metal are satisfactory, an improperly dried ladle may be responsible. Oxidized metal—or to use the foundry term, burned metal (burned in the cupola)—leaves the tap hole impregnated to a greater or lesser extent with gas. Some of the gas may escape, but the remainder stays in the metal to appear later as cavities or blow holes in the casting. Since some of your castings show this defect, while others poured from the same ladle are perfect, it is apparent that your melting conditions are not responsible for the present trouble. Therefore you can dismiss this factor and check on the other two, the state of the ladle and the condition of the mold.

Hard or wet sand, whether in the mold or in the ladle lining, will create steam in contact with molten metal. Some of this steam remains trapped in the metal to form blowholes in the casting. The wet ladle lining theory is plausible, but not necessarily accurate in every instance. Metal poured from an initially boiling ladle will produce gassy castings. If the boiling persists until the ladle is empty, all the castings will be gassy. However, in some instances the boiling action ceases after one or two castings have been poured. Remaining castings poured from that ladle will not show any porosity.

In the present instance the mold is the most probable cause of the trouble. If the bushings are molded and poured in a vertical position, and if several castings are grouped in one mold, an excessive amount of steam is generated. Some of the steam is trapped in the metal. The sand is rammed harder than usual to prevent the castings from straining. The obvious remedy is to work the sand as dry as possible, keep the patterns a reasonable distance apart and vent sand liberally with a wire.

Permanent Mold Cycle Is Slow

Q.—We are doing some experimental work in casting gray iron in permanent molds. We find that without a cooling system, the cycle of operation will be too long to be economical, and we fear that cooling the mold with water will tend to chill the casting. Is there any chemical or alloy that could be added to the molten metal that would aid in retaining the machining qualities of the casting? Or is there any facing or spray coating which could be applied to the face of the mold to prevent chilling of the casting, and thus hold the machining qualities? Also do you know of any way in which pure copper may be hardened without introduction of other metals as alloying agents?

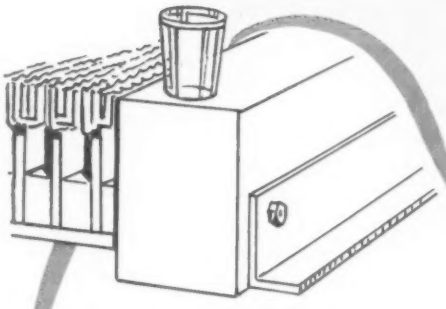
A.—Some 40 years ago Edgar A. Custer, one of the early proponents of the permanent mold process for manufacture of gray iron castings, produced them without any chilled sections by removing them from the mold as soon as the iron solidified, and allowing them to air cool. Over 20 years ago a foundry impregnated the mold faces with zinc, and claimed that it prevented chilling of the iron poured against the faces. However, additional precaution was taken by placing the hot castings in a powdered insulating medium for 24 hours. In 1926 cast iron pipe was produced in England and Europe by the centrifugal process, using metal molds whose surfaces were coated with silicon-bearing materials in a suitable adhesive to prevent chill. In 1934 in this country a similar procedure was patented which involved use of dry silicon-bearing materials or carbonaceous materials.

While you mention use of water as a cooling medium, possibly you might be able to speed up the cooling rate of the mold sufficiently by blowing air on it. Another medium instead of water is oil, and it could be used at a higher temperature so that cooling would not be so drastic. Evidently the molds you are using are heavy walled, and by machining ribs or fins on the outer surface, or inserting studs, the radiating surface could be increased sufficiently to decrease the cycle without running into chilled sections on the castings. Still another possibility is to try increasing the silicon content of the iron used for the castings when forced cooling of the molds is employed. In this discussion we have not mentioned the practice of annealing the castings after removal from the mold as we assume you are familiar with that

(*Concluded on page* 104)

For Your SNAP-FLASKS *and* LIGHT *to* MEDIUM MOLDS

Royer Shake-Out at National Bronze Co., Springfield, Mass.



Royer SHAKE-OUT

A shake-out built on an entirely different principle. Reciprocating, walking-beam action provides fast, efficient, thorough removal of sand from molded pieces. Sand falls between widely spaced grids—can't arch—can't clog. Torque of the eccentric drive is transmitted to the castings, flasks and bands, conveying them off the end of the shake-out . . . without damage to flasks or castings.

Adaptable to any type foundry production line layout. Recommended for use in connection with Royer Sand Separator and Blender. We will be glad to make suggestions as to effective layout for increased overall output. Write for information.

NO SELF-DESTRUCTION

Up-and-down motion of grids assures positive action over entire area without transmitting motion to frame. Actually the ROYER SHAKE-OUT operates with so little vibration that it will not spill a drop of water from a brimful glass placed on the frame. This vibrationless operation eliminates the only objectionable feature of the average mechanical shake-out—short service life and high cost of repair and replacement.

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FOREMOST IN SAND CONDITIONING EQUIPMENT

ROYER FOUNDRY & MACHINE CO.

159 PRINGLE ST., KINGSTON, PA.

Questions AND ANSWERS

(*Concluded from page* 102)

procedure and wish to avoid it.

The only way that we know of to harden copper without use of additions of other alloying materials is to cold-work it by rolling, hammering, forging, etc.

Casting Design Causes Trouble

Q.—We are enclosing a rough sketch of a roller with which we are having trouble. This is a copper-nickel mixture containing 64 per cent Cu, 21 per cent Ni, 7 per cent Zn, 3 per cent Sn, 3.70 per cent Pb, and 1.30 per cent Fe. We are experiencing shrinkage in the ribs as shown in Fig. 1, and while we have used chills on both sides of the ribs inside and also on the outside at the joint of the rib, we still are not getting satisfactory castings. We ordinarily do not have a great deal of trouble with this alloy, but this job is a "poser."

A.—Design of the casting shown in Fig. 1 makes it extremely difficult to avoid the trouble you are having, namely internal shrinkage in the ribs. The fact that the cross section of the ribs is much greater than the outside ring of the roller, means that the six ribs retain the heat and cool more slowly than the rim of the casting, which has all the cooling effect of the surrounding sand. If the box or flask in which the casting is made is fairly close fitting, more rapid cooling is provided than with a heavy layer of sand.

As the rim cools it draws on the ribs, with resultant shrinkage. If you chill the ribs on both sides as you indicate, then again you draw the metal away from the center of the ribs which only accentuates the first shrinkage. When you chill the ring itself, the same thing applies. As far as design is concerned it would be better if the ring thickness could be increased by adding metal to the outside until it is slightly heavier than the ribs, later machining the diameter to the desired size.

Assuming that you have to make the casting from the present design, we suggest the following: Extend the pattern and coreprint at one end, as indicated in Fig. 2, and then cast horizontally with the riser system shown—adapting the measurements to the requirements of your pattern. Casting temperature should be high, say 2300° F. If you do not anticipate trouble from the dross-forming proclivities of the zinc content of the alloy, you might try leaving out the horn-gate approach, and pour directly through the riser. The mold should be dry sand, and it is better to have two in a box or flask, as shown in Fig. 2, but you can use the same principle for one in a box. If the trouble still persists then, as a basic attack on the problem, cast one roller vertically and one horizontally without risers or chills. Fracture and examine the critical areas, or if you have difficulty in fracturing, saw through and deep etch. The deep etch will show up the shrinkage as well as fracturing. With that information you will be in a much better position to find a remedy for the difficulty.

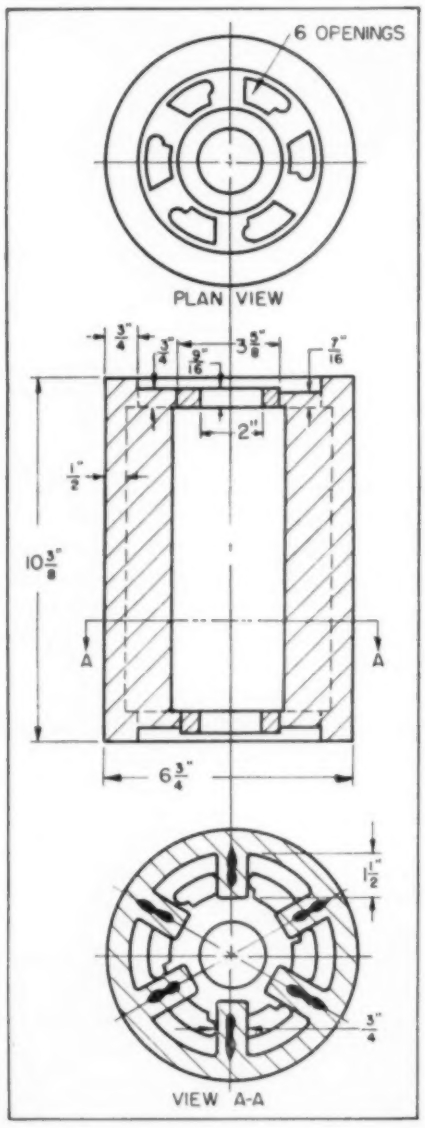
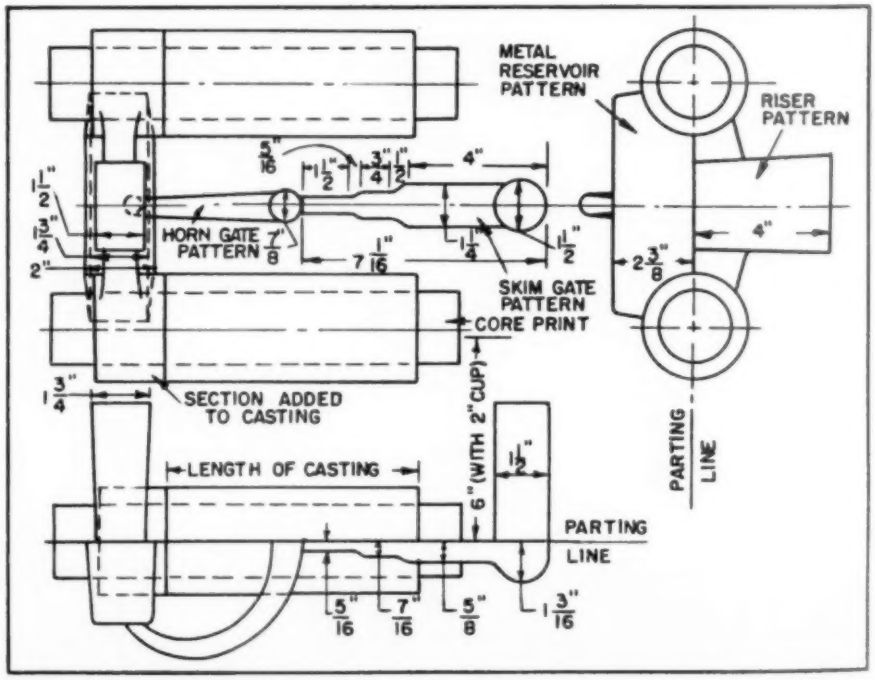


Fig. 1 (left)—Drawing showing principal dimensions and design of casting

Fig. 2 (below)—Suggested procedure for molding to obtain solidity



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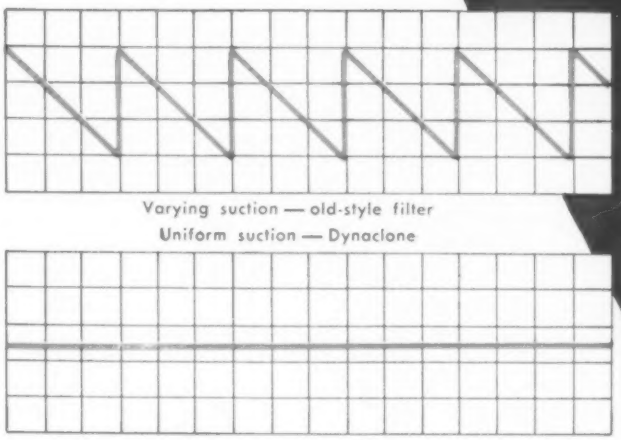

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5. Keeps itself automatically and continuously clean without additional power or equipment.

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This revolutionary new dust filter is another Sly first. Extremely simple and thoroughly dependable, it eliminates entirely the gremlin of mechanical shaking and provides uniform suction of air at dust source.

This uniform suction is achieved by a simple device which cleans the filter bags successively by a reverse flow of air—the same suction which draws the dust onto the filter cloth is reversed to blow it off.

Since this reverse air suction operates continually, the new Sly Filter requires no shutdowns for removing dust from the cloth.

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*Patent Applied for

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Men OF INDUSTRY

A. L. WENTZEL, newly elected president of the Reading Foundrymen's Association for the year 1950, is works manager, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. Mr. Wentzel, a graduate of Pennsylvania State College, served his apprenticeship in the pattern shop, foundry and machine shop at the Birdsboro company for two years. Following two years with Saginaw Malleable Division, General Motors Corp., as a foundry foreman and engineer on time study work, he returned to Birdsboro Steel Foundry & Machine Co., in 1937. During the following 8 years he was successively foundry foreman, night superintendent, service engineer, assistant to the vice president, and assistant works manager. In 1945 Mr. Wentzel was a member of the United States Strategic Bombing Survey Group in Europe which studied bombing effects in heavy German industry. He was vice president of the Reading Foundrymen's Association last year.

♦ ♦ ♦

Alvin J. Herzig has been elected president of the Climax Molybdenum Co. of Michigan, research subsidiary of Climax Molybdenum Co., New York. Mr. Herzig, a graduate of University of Michigan, joined the parent company in 1931, when the research laboratory was opened. Previously he had been employed as a research associate in the engineering research department of University of Michigan and later as a metallurgical assistant, National Supply Co., Toledo, O. He is an active committeeman of the ASTM, ASM and SAE and a member of AIME, British Iron and Steel Institute, and British Institute of Metals.

♦ ♦ ♦

Herbert M. Rich Jr. has been appointed general sales manager, Electro Metallurgical Division, Union Carbide & Carbon Corp., New York. Mr. Rich, who joined the corporation in 1942 after 10 years with Hickman, Williams & Co., in Detroit, served as New York district manager of Electro Metallurgical Sales Corp. from 1943 to 1946, when he became division manager of the New York and Birmingham territories. He will continue to make his headquarters in the New York offices of the company.

♦ ♦ ♦

Thomas C. Weiser, since 1946 in charge of the foundry division, Griffin Wheel Co., Chicago, has been appointed assistant operating manager, with headquarters at 415 North Sacramento Blvd., Chicago. Mr. Weiser joined the company in 1906 as a clerk, and later was appointed cashier in charge of the Chicago office. He was transferred to the operating department in 1917 and two years later became superintendent at the Boston plant. In 1930 Mr. Weiser was appointed superintendent at the company's mechanical plant at Council Bluffs, Iowa, returning to Boston in 1937 as superintendent when that plant was mechanized.

♦ ♦ ♦

John W. Brittingham, treasurer, Griffin Wheel Co., Chicago, recently was elected vice president and a director. Mr. Brittingham has been connected with the Griffin organization since 1937 and has held the position of treasurer since 1947. **Cedric P. Voll** was elected to the newly created post of controller. **James P. Maher,** sales representative, has been appointed assistant vice president with headquarters in Chicago. Mr. Maher became connected with the company in 1925, and after serving in various capacities in New York and in Cleveland, was transferred to the general sales office at Chicago in 1934.

♦ ♦ ♦

Dr. Robert F. Mehl, director of the Metals Research Laboratory and head of the Metallurgical Engineering Department, Carnegie Institute of Technology, has been appointed a member at large for 3 years of the National Research Council, National Academy of Sciences. Dr. Mehl was graduated from Franklin and Marshall College and received his Ph.D. from Princeton University in 1924. Prior to joining the Carnegie faculty in 1932 he was superintendent of the Division of Physical Metallurgy, Naval Research Laboratory, and assistant director of research, American Rolling Mill Co.

♦ ♦ ♦

G. R. Brophy, research metallurgist, has been named head of the New England technical section, International Nickel Co. Inc.'s Development & Research Division, Hartford, Conn. Mr. Brophy joined the cor-

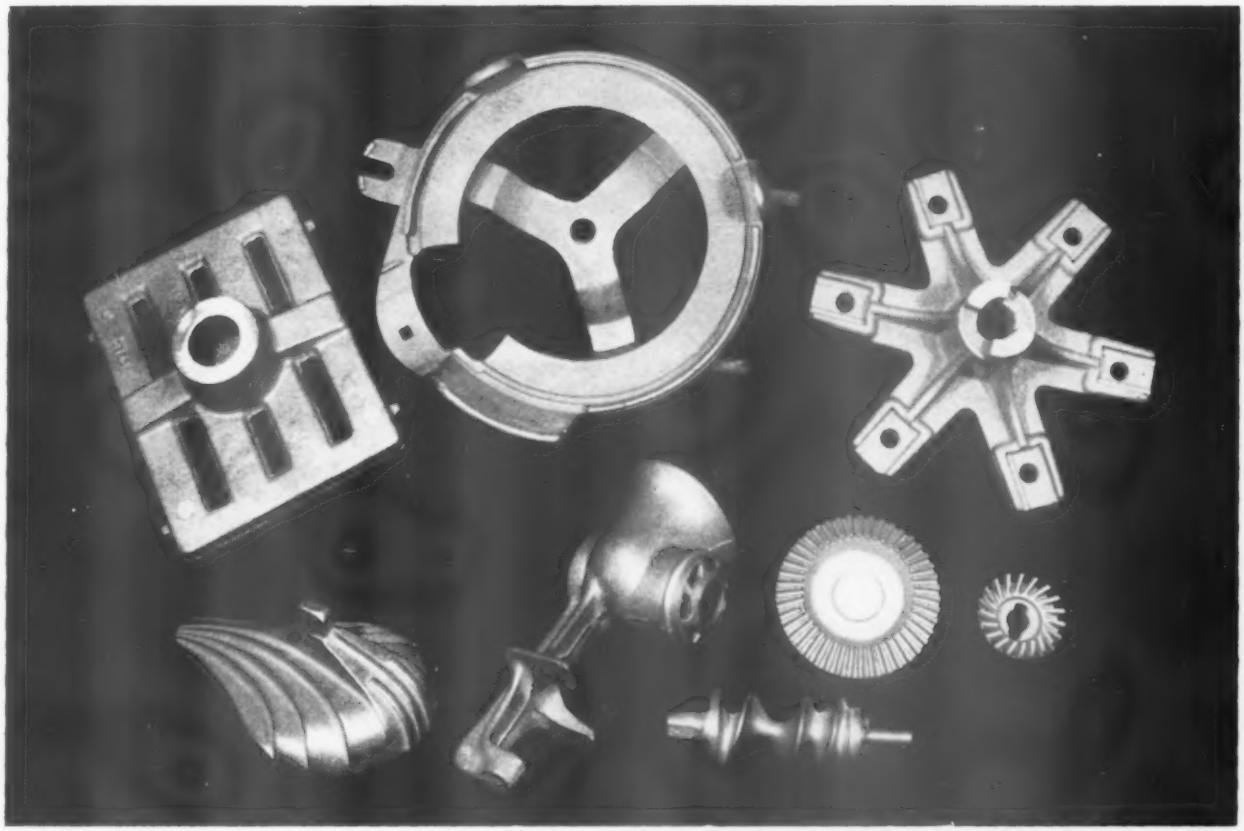
(*Continued on page* 108)

A. L. WENTZEL

ALVIN J. HERZIG

HERBERT M. RICH JR.

THOMAS C. WEISER



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Men OF INDUSTRY

(*Continued from page* 106)

poration in 1936 as research metallurgist in the research laboratory, Bayonne, N. J., and later was placed in charge of the laboratory's steel section.

♦ ♦ ♦

Maurice W. Daugherty has been appointed secretary of the Aluminum Research Laboratories of Aluminum Co. of America, in New Kensington, Pa., and will assume some of the administrative functions of the director's office. Mr. Daugherty, who joined the company in 1923 at the New Kensington plant, served at Niagara Falls, N. Y., before going to Cleveland in 1931. There he organized and developed the corrosion laboratory. **Walter E. Sicha** succeeds Mr. Daugherty as chief of the Cleveland Research Division. Mr. Sicha, who became associated with the company in 1928, as a metallurgist in the Cleveland sand foundry of the company, joined the Cleveland Research Division in 1943 and became assistant chief in 1948. **Alan M. Montgomery** has been named an assistant chief of the Cleveland Research Division, which he joined in 1939. In 1940 he became head of the metallographic group and has developed many of the metallographic techniques and practices for aluminum and magnesium casting and forging alloys.

♦ ♦ ♦

O. L. Earl has been elected president, Acme Aluminum Foundry Co., Chicago, succeeding the late Harry L. Ferguson. Mr. Earl, who joined the company as vice president and director, will be succeeded in those offices by **Harold Osborne,** retaining his position as secretary-treasurer. Prior to joining the company he was general sales manager, Mullins Mfg. Corp., Salem and Warren, O., with which he was associated for more than 18 years. Mr. Earl is chairman of the Aluminum and Magnesium Advisory Committee and a member of the Foundry Industry Advisory Committee, both of the Munitions Board of the Military Establishment. During the war he was on the advisory committee of the WPB and OPA, Washington.

♦ ♦ ♦

J. H. Berryman has been appointed assistant to **Scott D. Baumer,** manager, technical sales division, Air Reduction Sales Co., New York. Following graduation from Johns Hopkins University with a degree in mechanical engineering in 1935, he was assistant lubrication engineer at the Sparrows Point, Md., plant of Bethlehem Steel Co., Bethlehem, Pa. After 6 years in military service he joined Air Reduction in 1946, serving as machine welding specialist and additionally as assistant metallurgical engineer.

♦ ♦ ♦

Dr. Zay Jeffries, vice president in charge of the Chemical Department, General Electric Co., Pittsfield, Mass., has retired. Dr. Jeffries was graduated from South Dakota State School of Mines and received his Doctor of Science degree at Harvard University. In 1911 he joined the faculty of Case Institute of Technology, and in 1915 became director of research, Aluminum Castings Co., Cleveland, later becoming consulting metallurgical engineer for Aluminum Co. of America. He joined General Electric in 1914 as a consultant to its National Lamp Works, Cleveland. From 1932 to 1936 he was also president, Carboloy Co. Inc., a GE affiliate. In 1936 he became technical director of the Lamp Department and in 1945 he was elected a vice president and placed in charge of the newly formed Chemical Department. During the war Dr. Jeffries was vice chairman of the War Metallurgy Committee and has served as consultant in research and development work on the atomic bomb.

♦ ♦ ♦

Paul L. McCulloch Jr. has been transferred to the Pittsburgh district sales office, American Brake Shoe Co., New York. Mr. McCulloch, formerly located in Rochester, N. Y., has been appointed sales engineer for the American Manganese Steel and Electro-Alloys Divisions, succeeding **M. A. Zeller** who has resigned. He joined the company in 1945 after attending Columbia and Temple universities.

♦ ♦ ♦

M. W. Heinritz, vice president, Gould Storage Battery Corp., Trenton, N. J., has been named president of the Electric Industrial Truck Association, succeeding **F. J. Shepard Jr.,** treasurer, Lewis-Shepard Products, Watertown, Mass. **W. A. Meddick,** vice president-sales manager, Elwell Parker Electric Co., Cleveland, became vice president of the organization, a position previously held by Mr. Heinritz. **William Van C. Brandt,** Philadelphia, managing director of the association, was re-elected secretary-treasurer.

♦ ♦ ♦

George D. Prest Jr. has been transferred from Chicago sales engineering department, Lindberg Engineering Co., to the new office of the company in Los Angeles.

♦ ♦ ♦

John E. Harris has been appointed technical adviser to **B. T. Hain,** vice president in charge of manufacturing, National Radiator Co., Johnstown, Pa.

(*Continued on page* 110)

MAURICE W. DAUGHERTY

WALTER E. SICHA

ALAN M. MONTGOMERY

O. L. EARL

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Men OF INDUSTRY

(*Continued from page* 108)

Mr. Harris will handle technical problems and developments involving manufacturing processes at the company's plants in Johnstown, New Castle and Middletown, Pa., and Trenton, N. J. He joined National Radiator in 1943 as plant superintendent of the plastic metals division in Johnstown, and previously had been superintendent of the electrode division, McKay Co., York, Pa.

♦ ♦ ♦

Herbert J. Cooper, until recently engaged in practical research in development of centrifugal casting and

HERBERT J. COOPER

oxygen injection techniques, has been appointed assistant to the general manager, the Cooper Alloy Foundry Co., Hillside, N. J. Mr. Cooper, who was graduated from Columbia University School of Metallurgy, was formerly associated with Bethlehem Steel Co., Bethlehem, Pa.

♦ ♦ ♦

J. C. Kemp, until recently general sales engineer, Ampco Metal Inc., Milwaukee, has been appointed district manager of the company's Chicago office. Mr. Kemp, who was formerly sales engineer in the Cleveland office, has been succeeded as general sales engineer by **R. J. Eckl,** his former assistant.

♦ ♦ ♦

Joseph M. Temple has been appointed manager of the Baton Rouge, La., branch office, Foxboro Co., Foxboro, Mass., succeeding **John B. Deaderick,** who has been made manager of the Tulsa, Okla., office. Mr. Temple attended Louisiana State University and until recently was sales engineer with J. B. Beaird Co., Shreveport, La. Prior to military service during the war, he was associated with Petroleum Engineering Inc., Houston, Tex., as a field engineer and plant superintendent.

♦ ♦ ♦

L. J. Buckley has been named manager of the accessories department, Steel Sales Corp., Chicago, which was established recently to make available from one source, fastenings, pipe fittings, wire rope, safety tools, etc., as well as certain special alloys and precision castings and forgings.

♦ ♦ ♦

Henry F. DeBardeleben II, formerly president, DeBardeleben Coal Corp., Birmingham, has been elected chairman of its board of directors. **Newton H. DeBardeleben,** executive vice president of the company since 1947, and who has been named the new president, is a graduate of University of North Carolina and Yale University. A grandson of pioneer coal and iron producer **Henry F. DeBardeleben,** he has served in all departments of the coal corporation since he was released from Navy service in World War II.

♦ ♦ ♦

Paul Fassotte, well known steel foundry consultant in England, was honored Dec. 6 at a dinner attended by many of his friends and associates. Mr. Fassotte, a native of Belgium, has spent the greater part of his business life in England and has contributed greatly to progress made in steel founding through advice and presentation of technical papers. During the war he was director of steel castings at the Ministry of Supply.

♦ ♦ ♦

William A. Casler has been appointed assistant director of research, Armour Research Foundation, Illinois Institute of Technology, Chicago. Mr. Casler joined the foundation staff in 1946 as a research engineer after serving four years in that capacity at Caterpillar Tractor Co., Peoria, Ill. **K. W. Miller** continues as assistant director of research in charge of technical and professional development.

♦ ♦ ♦

Chris T. Jensen, for the last 5 years direct factory representative in several southern Wisconsin cities for Cleveland Flux Co., Cleveland, has been appointed representative for the entire state of Wisconsin.

♦ ♦ ♦

Conrad C. Wissmann, formerly metallurgist, Los Angeles Steel Castings Co. Ltd., Los Angeles, has been appointed research metallurgist, Solar Aircraft Co., San Diego, Calif. Mr. Wissmann, who was graduated from University of California, was previously associated with Columbia Steel Corp., Torrance, Calif., and Haberfeld Steel Foundry, Bakersfield, Calif.

♦ ♦ ♦

G. G. Beard has been elected executive vice president, United Engineering & Foundry Co., Pittsburgh. Mr. Beard, who joined the company in 1927 as an engineer, became a vice president in 1943 and a director in 1944. He is also president of Lobdell United Co., Wilmington, Del., and Stedman's Foundry & Machine Works Inc., Aurora, Ind., subsidiaries of United Engineering & Foundry Co.

♦ ♦ ♦

R. J. Wilcox, who was elected chairman of the Detroit Chapter of the AFS for 1949-1950, is technical

R. J. WILCOX

director, Michigan Steel Casting Co., Detroit. Mr. Wilcox was graduated from Case Institute of Technology in 1923. Following a period with National Malleable & Steel Casting Co., Cleveland, and some experience in automotive valve metallurgy, he joined Michigan Steel Casting Co. in 1928, where he was in charge of melting operations, metallurgy and foundry control until his appointment as technical director in 1946. Mr. Wilcox has been active in the Alloy Casting Institute and Steel Founders' Society of America and is a member of the ASM, ASTM, Electric Metal Makers Guild, as well as the AFS.

♦ ♦ ♦

Thomas C. Ford has joined Pittsburgh Metallurgical Co., Niagara Falls, N. Y., and will handle sales in the Pittsburgh and Ohio areas, in association with **John T. Mechem,** eastern sales manager. Mr. Ford, whose headquarters will be in Pitts-

(*Concluded on page* 112)

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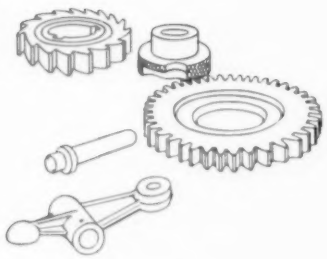

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(*Concluded from page* 110)
burgh, was formerly district sales manager, Electro Metallurgical Co., in the Pittsburgh territory.

♦ ♦ ♦

J. J. Davis Jr., manager of sales, railroad division, Inland Steel Co., Chicago, has been named to assume responsibility also for pig iron and chemical sales. **A. C. Engh** has been appointed manager of the pig iron and chemical section of the consolidated sales units.

♦ ♦ ♦

C. E. Herington, for the last 11 years advertising and sales manager, Meehanite Metal Corp., New Rochelle, N. Y., has organized his own industrial advertising agency, Herington Advertising Inc., 271 North Ave., New Rochelle, N. Y. Mr. Herington will specialize in industrial accounts, with particular emphasis upon technical publicity, public relations, direct mail and market development programs.

♦ ♦ ♦

William J. Grede, president, Grede Foundries Inc., Milwaukee, has been elected president of the Midwest Manufacturers Association Inc., and **L. D. Harkrider,** president, General Malleable Corp., Waukesha, Wis., has been elected one of its directors. **Robert Ewens,** executive vice president of the Wisconsin Manufacturers' Association, has been elected secretary of the Association of State Industrial Associations Inc., a recently formed organization of 35 state manufacturers' associations.

♦ ♦ ♦

John H. Kishman has been appointed district manager for Ohio, excepting Toledo, and western Pennsylvania, by the Simonds Abrasive Co., Philadelphia. Previously the company's sales representative in southern Ohio, with headquarters in Dayton, Mr. Kishman will now center his activities principally in Cleveland and Pittsburgh.

♦ ♦ ♦

Victor M. Rowell, formerly sales technician, Velsicol Corp,. Chicago, is now associated with the Trabon Co., 122 S. Michigan Ave., Chicago, manufacturer of core oils and chemicals and manufacturers' agent for foundry supplies. He will devote his time to technical service.

♦ ♦ ♦

Orum R. Kerst has been appointed to head the north section of the eastern sales division, E. F. Houghton & Co., Philadelphia. Mr. Kerst, formerly New England representative for the company, will continue to have his headquarters in Worcester, Mass.

♦ ♦ ♦

Robert T. Pring has been appointed technical director, Dust and Fume Division, American Wheelabrator & Equipment Corp., Mishawaka, Ind. Mr. Pring was recently director of the Industrial Hygiene Department, Kennecott Copper Corp., New York.

♦ ♦ ♦

Clarence B. Ringham has been appointed factory manager of the heavy machinery divisions, Chain Belt Co., Milwaukee. Mr. Ringham has been associated with Chain Belt since 1927, and was formerly superintendent of plants in West Milwaukee.

St. Louis Pattern Group To Supervise Trainee

ST. LOUIS, which has what is claimed to be the most outstanding apprenticeship program in the United States, has been selected by the Departments of State and Labor as the site to further the training of Luis Mojicar, a young Cuban industrial trainee brought here under a program designed to permit young men of foreign countries to work in American factories and observe American living standards and industrial practices.

Mr. Mojicar is the first foreign patternmaker to be brought to the United States in the International Industrial Training Program. A graduate of an industrial technological school in Cuba, he has had approximately three years' experience working in a foundry. Mr. Mojicar will work for about ten months in various St. Louis area pattern shops under the supervision of the St. Louis Pattern Makers' Joint Apprenticeship Committee.

The program under which Mr. Mojicar will receive training was formulated five years ago when the Employers' St. Louis Pattern Manufacturers Association and the AFL patternmakers' union met with the Department of Labor's Bureau of Apprenticeship to improve techniques of apprenticeship training. The St. Louis Joint Apprenticeship and Training Committee thus formed has met periodically ever since to consider and approve applications, and to decide on apprenticeship matters. The committee's activities also include supervision of a related patternmaking training course, and the giving of periodical examinations to apprentices. Because of the complexities of the patternmaking trade, many problems were evident which took both the co-operation and patience of management and labor to work out satisfactorily.

Not only has the committee ironed out the basic problems of apprenticeship, but it has continued to meet periodically until it has developed and established apprenticeship standards which make journeymen in every sense of the word. As a result of these activities it is more than a coincidence that within the past few years two St. Louis apprentice patternmakers, trained under the supervision of the joint committee, have won the AFS National Patternmakers' Contest, and, more recently, that the United States Department of Labor has placed Luis Mojicar under the committee's supervision for furtherance of his education.

St. Louis Joint Apprenticeship and Training Committee meets with Bureau of Apprenticeship representatives. Left to right: Ernest Kramer and Arthur W. Nolte, union members; George W. Apel Bureau of Apprenticeship area supervisor; F. W. Burgdorfer, Missouri Pattern Works, committee chairman; Luis Mojicar, Cuban industrial trainee; R. S. Cardwell, union member, committee secretary; C. E. Rutledge, Bureau of Apprenticeship, consultant to the committee; E. E. Belton, Progressive Pattern Co.; Elmer Parker, pattern shop superintendent, Fulton Iron Works Co.

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Today, this furnace and five similar furnaces in the same plant—all equipped with B&W IFB linings and B&W 80 Firebrick piers—**are malleableizing 450 tons of castings a day without interruption!**

Equally important, the use of B&W Insulating Firebrick has helped to reduce cycle time from 72 hours—required in old type furnaces lined with heavy firebrick—to 30 hours. Significant fuel savings, and improved product quality through closer temperature control have also been achieved.

If you are looking for ways to increase your production and decrease your costs, the use of B&W Refractories in your furnaces will prove of assistance. Your local B&W Refractories Engineer will be pleased to discuss your problems with you.

R-324

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AFS Announces

OFFICER, DIRECTOR NOMINEES and TENTATIVE CONVENTION PROGRAM

NOMINATIONS for new officers and directors of the American Foundrymen's Society have been made by the AFS Nominating Committee. Currently serving the society as vice president, Walton L. Woody, vice president of operations, National Malleable & Steel Castings Co., Cleveland, is the presidential nominee for 1950-51. Named to succeed Mr. Woody as vice president is Walter L. Seelbach, president and general manager, Superior Foundry Inc., Cleveland.

Nominees for three-year directorships are: J. J. McFadyen, general manager, Galt Malleable Iron Co., Galt, Ont., Canada; J. O. Ostergen, president, Lakey Foundry & Machine Co., Muskegon, Mich.; Frank W. Shipley, foundry manager, Caterpillar Tractor Co., Peoria, Ill.; James Thomson, chief engineer, Continental Foundry & Machine Co., East Chicago, Ind., and E. C. Troy, foundry engineer, National Engineering Co., Philadelphia. In addition, and as prescribed by the by-laws, E. W. Horlebein, Gibson & Kirk Co., Baltimore, and now president of the society, will serve a one-year term as director.

Election of new officers and directors will take place at the annual business meeting to be held at Cleveland, Wednesday afternoon, May 10, during the 54th annual convention.

Other features of the Cleveland Congress and Foundry Show are listed in the accompanying tentative program. As in previous years, technical sessions covering the various metal interests—gray iron, steel, malleable, nonferrous, etc.—are being grouped to accommodate the greatest number throughout Convention Week. A change from practice of recent years is scheduling the banquet on Wednesday evening instead of the last day of the convention.

Application forms covering hotel accommodations at Cleveland were mailed from Chicago headquarters Jan. 6 to all society members, convention authors and speakers, and to all exhibitors of record as of that date. Reservations will be made only through the AFS Housing Bureau, operated by the Cleveland Convention and Tourist Bureau.

The 1950 convention is being built around the theme "Better Castings at Less Cost" and already promises to be exceptional in point of attendance, and number and quality of exhibits and technical papers. Applications for exhibit space at the Foundry Show in Cleveland's Public Auditorium have set a record to date. By Jan. 1 approximately 60 per cent of the total area to be used for exhibits had been applied for.

Committees in addition to a General Committee have been appointed by the Northeastern Ohio host chapter to handle various arrangements for the convention. Heading these

(*Concluded on page* 117)

TENTATIVE PROGRAM

AFS Congress and Foundry Show
Cleveland, May 8 to 12

Monday, May 8

10 a.m.—Registration and Exhibits open
10 a.m.-12—Technical sessions: Aluminum & Magnesium, Brass & Bronze, Malleable
12 noon—Aluminum & Magnesium roundtable luncheon
1-9:30 p.m.—Northeastern Ohio Day—(free admission for local plant men)
2-4 p.m.—Technical sessions: Brass & Bronze, Malleable
4-6 p.m. — Technical sessions: Aluminum & Magnesium, Brass & Bronze
5:30 p.m.—Registration closes
6:30 p.m.—Nonferrous "Son-Father" dinner
7 p.m.—Chapter Officers & Directors dinner
8-10 p.m.—Technical sessions: Gray Iron Shop Course, Sand Shop Course, Nonferrous Shop Course
9:30 p.m.—Exhibits close

Tuesday, May 9

9 a.m.—Registration and Exhibits open
10 a.m.-12—Technical sessions: Heat Transfer, Aluminum & Magnesium, Brass & Bronze, Malleable
12 noon—Brass & Bronze roundtable luncheon, Malleable roundtable luncheon
2-4 p.m. — Technical sessions: Aluminum & Magnesium, Sand, Joint, Sand & Steel
4-6 p.m.—Technical sessions: Brass & Bronze, Pattern, Educational, Aluminum & Magnesium
5:30 p.m.—Exhibits close
7 p.m.—Canadian dinner, Educational dinner

Wednesday, May 10

9 a.m.—Registration and Exhibits open
10 a.m.-12 — Technical sessions: Sand, Gray Iron & Malleable, Refractories
12 noon — Pattern roundtable luncheon, Gray Iron roundtable luncheon
3 p.m. — Exhibits close. Annual business meeting
4 p.m.—Charles Edgar Hoyt Annual Lecture
5 p.m.—Registration closes
7 p.m.—Annual AFS banquet

Thursday, May 11

9 a.m.—Registration and Exhibits open
10 a.m.-12 — Technical sessions: Management Functions & Controls, Gray Iron, Steel, Sand
12 noon—Steel roundtable luncheon
2-4 p.m. — Technical sessions: Time Study & Methods, Gray Iron
4-6 p.m.—Technical sessions: Steel, Gray Iron, Plant & Plant Equipment
5:30 p.m.—Exhibits close
7 p.m.—AFS Alumni dinner (invitational)
8 p.m.—Technical sessions: Plant & Plant Equipment, Gray Iron Shop Course, Sand Shop Course

Friday, May 12

9 a.m.—Registration and Exhibits open
10 a.m.-12 — Technical sessions: Gray Iron, Steel
2-4 p.m.—Technical sessions: Gray Iron, Steel
4-6 p.m.—Technical sessions: Gray Iron, Steel
4:30 p.m.—Exhibits officially close

WALTER L. SEELBACH
1950-51 Vice Presidential Nominee

WALTON L. WOODY
1950-51 Presidential Nominee

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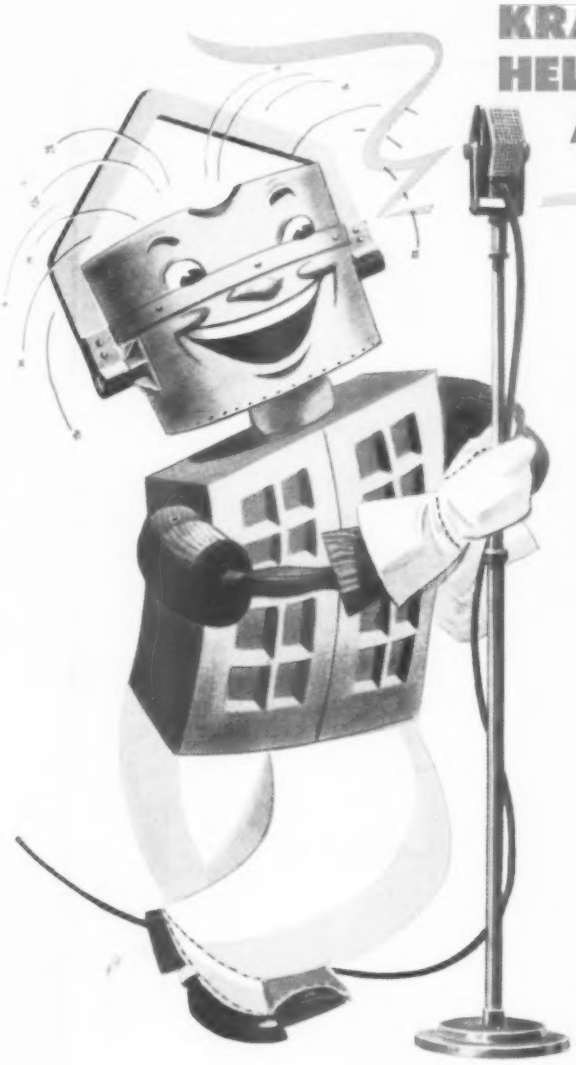

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(*Concluded from page* 114)
various groups are: Reception Committee—Cleve H. Pomeroy, National Malleable & Steel Castings Co., chairman, Walter L. Seelbach, Superior Foundry Inc., vice chairman; Plant Visitation Committee — Lewis T. Crosby, Sterling Wheelbarrow Co., chairman, John Schneider, Cleveland Electric Illuminating Co., vice chairman.

Banquet Committee — Gilbert J. Nock, Nock Fire Brick Co., chairman, Russell F. Lincoln, R. F. Lincoln Co., vice chairman; Shop Course Committee—Vincent J. Sedlon, Master Pattern Co., chairman, Maurice F. Degley, Ferro Machine & Foundry Co., vice chairman; Northeastern Ohio Day Committee—John A. Sharritts, Westinghouse Electric Corp., chairman, Leslie Schuman, National Malleable & Steel Castings Co., vice chairman; Ladies Entertainment Committee—Mrs. Frank G. Steinebach, chairman, Mrs. Gilbert J. Nock, vice chairman; Publicity Committee —Robert H. Herrmann, THE FOUNDRY, chairman, Sterling N. Farmer, Sand Products Corp., vice chairman.

ELECTRIC FURNACE STEEL COMMITTEE

Sponsors Annual Conference

By EDWIN BREMER
Metallurgical Editor
THE FOUNDRY

NEARLY 600 attended the seventh annual Electric Furnace Steel Conference held at Hotel William Penn, Pittsburgh, Dec. 8, 9 and 10. It was sponsored by the Electric Furnace Steel Committee of the Iron and Steel Division, American Institute of Mining and Metallurgical Engineers. The first day was devoted to joint sessions of the acid and basic groups on materials handling and temperature and composition measurements. Second day's sessions consisted of discussions on operating improvements and electric furnace refractories by the basic furnace operators, and on use of oxygen and gases other than oxygen by the acid furnace operators. Meeting on Saturday morning was an educational session on chemistry of electric furnace steelmaking.

Annual reception and dinner Thursday night was presided over by James W. Kinnear Jr., Firth-Sterling Steel & Carbide Corp., and Gene Flack, Sunshine Biscuits Inc., was the speaker. John B. Caine, Sawbrook Steel Castings Co., Lockland, O., was presented a placque and certificate in recognition of his services for the Electric Furnace Steel conferences. In the election of officers James A. Bowers, American Cast Iron Pipe Co., Birmingham, chairman of this conference, was advanced to chairman of the executive committee while T. J. McLoughlin, Carnegie-Illinois Steel Corp., Pittsburgh, was made chairman of the forthcoming eighth conference to be held at Pittsburgh Dec. 7, 8 and 9, 1950. Vice chairman of the eighth conference will be R. H. Frank, Bonney-Floyd Co., Columbus, O.

First session on materials handling was directed by Co-chairmen Gilbert Soler, Atlas Steels Ltd., Welland, Ont., and G. A. Lillieqvist, American Steel Foundries, East Chicago, Ind. W. G. Nichol, Carnegie-Illinois Steel Corp., Pittsburgh, pointed out that handling costs are 30 per cent of the final cost of the product. Hence, any improvement in methods will increase productivity of the worker and reduce labor cost. It also will increase utilization of equipment, provide lower accident rates and should improve labor relations.

JAMES A. BOWERS
President
Electric Furnace Steel Committee

Frank C. Weir, Timken Roller Bearing Co., Canton, O., in describing the use of fork trucking for handling electric furnace supplies, said that movement is expedited at reasonable cost. John C. Wyandt, Republic Steel Corp., Canton, O., cited the advantages of palletized loads of furnace electrodes. They are stored inside the plant and so arranged as to be used up in order of receipt. Floyd O. Lemmon, Ohio Steel Foundry Co., Springfield, O., discussed methods of handling materials in his foundry. These included the substitution of conveyor belts for hand unloading of sand, yard crane and magnet for unloading steel scrap and pig iron, use of tractors with trailers, skids, etc.,

Afternoon session on temperature and compositions measurements under Co-chairmen Frank Garratt, Universal-Cyclops Steel Corp., Pittsburgh, and Floyd O. Lemmon, Ohio Steel Foundry Co., Springfield, O., first dealt with methods of avoiding stratification in the bath. Sven Fornander, Surahammars Bruks AB, Surahammar, Sweden, presented a paper prepared in co-operation with Folke Nilsson, Hagfors Steelworks Uddeholms AB, Uddeholm, Sweden, which described application of induction currents to stir the bath in the electric furnace. Bottom of the furnace is nonmagnetic and the induction unit which is installed beneath the bottom uses two phases of power to produce a stirring movement in the liquid bath of 13 to 20 ft per second. Results from use of inductive stirring show more uniform distribution of bath temperature, more effective slagging off, etc.

J. J. Green, Universal-Cyclops Steel Corp., Bridgeville, Pa., described the reladling procedure to obtain uniform bath composition in high chromium and chromium-nickel stainless steels. Method consists of tapping out a portion of the molten bath, and pouring it back into the furnace. Advantages claimed are elimination of the disagreeable job of rabbling, reduction of off-composition heats to under 2 per cent, and reduction in temperature of the bath. J. H. Kennedy, Republic Steel Corp., Canton, O., described the use of argon gas for stirring the bath, and W. M. Patterson, Allegheny-Ludlum Steel Co., Brackenridge, Pa., discussed the use of large paddles and mixing balls to stir the charge.

Different methods of temperature determinations of the steel bath were discussed by several speakers. C. B. Post, Carpenter Steel Co., Reading, Pa., prepared a paper in conjunction

with D. G. Schoffstall of the same firm which described an immersion type unit using a Rayotube inserted in a tube through which dry nitrogen is driven to provide a clear area of metal on which the tube is sighted. D. G. Harris, Republic Steel Corp., Canton, O., gave results obtained with use of the platinum-platinum rhodium immersion type unit, and E. G. Wagner, Carnegie-Illinois Steel Corp., Duquesne, Pa., spoke on use of a Brown Instrument Co. electronic unit. G. A. Lillieqvist, American Steel Foundries, East Chicago, Ind., discussed data obtained with immersion temperature indicators and the spiral fluidity test.

Use of the spectrograph for control of heats as well as for analysis of the product was discussed by a number of speakers including Earl Vance, Timken Roller Bearing Co., Canton, O.; P. R. Irish, Bethlehem Steel Co., Bethlehem, Pa.; G. Nahstoll, Ford Motor Co., Dearborn, Mich. and M. L. Windle and W. H. Magrun, Simonds Saw & Steel Co., Lockport, N. Y.

Friday morning's session was devoted to a discussion of oxygen in electric furnace melting, and the afternoon session was concerned with gases other than oxygen in steel. Opening paper at the morning meeting was by Clyde Wyman and Charles A. Faist, Burnside Steel Foundry Co., Chicago, and described an investigation on the effect of various variables on oxygen-decarbonized steel heats. Data obtained was presented in the form of graphs or charts which, according to the authors, established trends which could be evolved into a general pattern for control purposes.

Several speakers, including C. C. Spencer, Electric Steel Castings Co., Indianapolis; J. W. Juppenlatz, Lebanon Steel Foundry, Lebanon, Pa.; C. J. Jernstrom, Cooper Alloy Foundry Co., Arlington, N. J.; W. T. Bryan, Duriron Co. Inc., Dayton, O., and J. B. LaPota and L. H. DeWald, National Cylinder Gas Co., Chicago, discussed use of oxygen in steel melting. Consensus was that the practice leads to small volumes of slag which can be controlled more easily since reactions are rapid with small bulk.

Concluding paper, on production of high-chromium steel in the acid arc furnace, was presented by D. C. Hilty, Union Carbide & Carbon Research Laboratories, Niagara Falls, N. Y.

Limit Hydrogen Pick Up

Afternoon session, with H. H. Blosjo, Minneapolis Electric Steel Castings Co., Minneapolis, and M. T. McDonough, National Malleable & Steel Casting Co., Sharon, Pa., presiding, dealt with gases other than oxygen in steel. First paper by Sam F. Carter Jr., American Cast Iron Pipe Co., Birmingham, was entitled "Melting Practice on Hydrogen" and described an investigation of the amount of hydrogen in steels produced under varied melting practices. Results indicated that chemistry of the steel has considerable effect on hydrogen absorption tendencies. Atmospheric humidity also has an effect but is influenced by the chemistry of the steel and the sequence of operations. Because of the maximum affinity for hydrogen in the ready-to-tap condition, hydrogen increases from improperly dried ladles, spouts, etc., apparently ruin more heats than conditions within the furnace. Considerable preheating of ladles at high temperatures is required to remove combined water in clay refractories.

Concluding paper, on "Flushing Hydrogen from Molten Steel with Neutral Gases," was presented by C. E. Sims, Battelle Memorial Institute, Columbus, O. It indicated that efficiency of nitrogen, argon and helium in removing undesired gases in molten steel is about the same, except that some nitrogen is absorbed by the steel. Reduction of hydrogen from 0.19 relative volume to 0.05 relative volume requires about 300 cu ft of argon per ton of steel. According to Mr. Sims, use of gases for flushing is no more efficient in eliminating hydrogen than a proper carbon boil.

WISCONSIN REGIONAL CONFERENCE

To Be Held Feb. 9-10

CONTINUING their series of regional foundry conferences, the Wisconsin Chapter of the AFS and the University of Wisconsin have scheduled the 13th annual two-day meeting for Feb. 9-10. As in past years, the conference will be held at the Schroeder Hotel, Milwaukee.

Chairman of the committee arranging the conference is W. W. Edens, Badger Brass & Aluminum Co., Milwaukee, who is also vice chairman of the Wisconsin Chapter. Co-chairman of the committee is George Tisdale, Zenith Foundry Co., Milwaukee, and Profs. E. R. Shorey and George J. Barker of the University of Wisconsin are associate chairmen. Program chairman J. G. Risney, Risney Foundry Equipment Co., Milwaukee, has developed a program which covers all branches of the foundry industry, featuring speakers who are nationally recognized authorities on their subjects. Featured speaker at the banquet Thursday evening is Gov. Oscar Rennebohm of Wisconsin.

Tentative program is:

Thursday, Feb. 9

9 a.m.—*Registration*

10-11:50 a.m.—*Welcoming Address,* Dean M.O. Withey, College of Engineering, University of Wisconsin and E. W. Horlebein, Gibson & Kirk Co., Baltimore, national AFS president

12 noon—*Luncheon Meeting:* Kenneth Haagensen, director of public relations, Allis-Chalmers Mfg. Co., Milwaukee

2-3:30 p.m.—

Steel: "Routing of Castings through the Cleaning Room," Lester B. Knight, Lester B. Knight & Associates, Chicago

Gray Iron: "Slight Variables Affect Sand Properties," Norman J. Dunbeck, Eastern Clay Products Co., Jackson, O.

Malleable Iron: "Progress through Motion and Better Methods," E. E. Braun and S. D. Martin, Central Foundry Division, General Motors Corp., Danville, Ill.

Nonferrous: "Precision Aluminum Castings," Hiram Brown, Solar Aircraft Corp., Des Moines, Iowa

Pattern: "Gating of Gray Iron Castings," D. I. Dobson, General Malleable Corp., Waukesha, Wis.

Technical: "Spectrophotometer," C. D. Coleman

3:40-5:10 p.m.—

Steel: "Mold Cavity Gas Formation as Related to Steel Castings," Charles Locke, Armour Research Foundation, Chicago

Gray Iron: "New Evaluation of Casting Processes by Navy Research," Harry H. Harris, Alloy Engineering & Casting Co., Champaign, Ill.

Malleable Iron: "Getting the Most Out of Your Molding Machines," W. W. Eichenberger, Milwaukee Division, SPO Inc., Milwaukee

Nonferrous: "Some Bronze Problem Castings," R. A. Colton, Federated Metals Division, American Smelting & Refining Corp., New York

Pattern: "Pressure Cast Aluminum Patterns and Coreboxes," J. N. Mathias, Accurate Match Plate Co., Chicago

Technical: "Zirconium Sands," speaker to be announced

6:30 p.m.—*Banquet:* Speaker, Oscar Rennebohm, governor of Wisconsin

Friday, Feb. 10

10-11:50 a.m.

Steel: "Gating Practices," Fred B. Riggan, Key Co., East St. Louis, Ill.

Gray Iron: "The Cupola, Its Raw Material and Its Operation," B. P. Mulcahy, Fuel Research Laboratory Inc., Indianapolis

Malleable Iron: "Foundry Mechanization for a Job Shop," P. C. DeBruyne, Moline Malleable Iron Co., St. Charles, Ill.

Nonferrous: "Cleaning Room Practices," H. E. Younger, Chicago Faucet Co., Chicago

Pattern: "Modern Pattern and Foundry Supplies," speaker to be announced

Technical: "Gases Used in Metallurgical Processes," speaker to be announced

12 noon—*Luncheon Meeting:* Speaker, Edward McFaul, Mid-West Institute, Chicago, "So You Think You Are Slipping"

2:30-4:00 p.m.

Steel: "Product Development," William J. Phillips, Steel Founders' Society of America, Cleveland

Gray Iron: "Discussion of Stress Analysis Problems," speaker to be announced

Malleable Iron: "Simple Metallurgy of Malleable Iron," L. R. Friedman, National Malleable & Steel Castings Co.

Nonferrous: "Information Forum," speakers panel: E. W. Smith, Western Material Co., Chicago; John A. Budnik, Wisconsin Aluminum Foundry Co., Manitowoc, Wis.; Walter W. Edens, Badger Brass & Aluminum Foundry Co., Milwaukee; Tom Kramer, W. F. Jobbins Inc., Peoria, Ill.; and M. E. Nevins, Wisconsin Centrifugal Foundry Inc., Waukesha, Wis.

Pattern: "National Pattern Program," L. F. Tucker, City Pattern & Foundry Co., South Bend, Ind.

Technical: "Permanent Molds," E. C. Hoenicke, Foundry Division, Eaton Mfg. Co., Detroit

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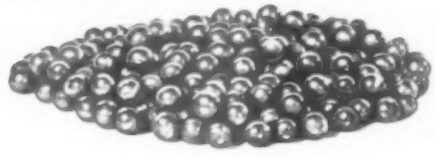

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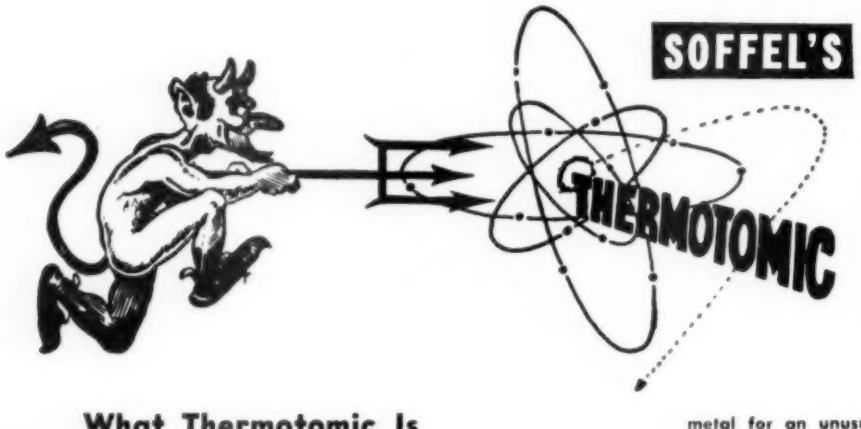
√ Makes Better Castings

FOR STEEL, STAINLESS STEEL, GRAY OR MALLEABLE IRONS, COPPER, BRASS AND BRONZE



Reduces Sizes of Riser and Feeder Heads

Heads and Risers Removed without Cutting and Burning

Increases Yield

Eliminates Shrinkage and Piping in Castings

What Thermotomic Is

Thermotomic Compound is an exothermic material which can be molded and baked into any desired shapes just as sand cores are made. It produces a temperature up to 3500° F. It is used as ring inserts under the risers or feeding heads, or as facing inserts where it is desirable to maintain the fluidity of metal in the mold at those points where rapid cooling may cause piping, shrinkage, or segregation. Great savings are realized through reduced riser dimensions and cleaning costs.

Thermotomic For All Metals and Alloys

The widely different characteristics of metals used in castings require that Thermotomic be available with characteristics which will suit specific metals. Here are the types of Thermotomic and their uses:

Thermotomic "X":
For general use except aluminum. Our newest development—hotter and faster acting. Retains the heat longer in feeding metal. Permits a higher baking temperature, up to 550° F. It is being used with great success in nodular iron, malleable iron, stainless and non-ferrous metals. Can be used in dry or green sand molds.

Thermotomic X-235:
This brand of Thermotomic is recommended for iron and steel when it is desired to maintain the temperature of the feeding metal for an unusually long period of time. THERMOTOMIC X-235 has a double exothermic reaction; that is, after having burned through once, the terrific heat developed serves to set off another chain of chemical reactions within the material causing it to burn again with the development of even greater heat than that produced by the first burning.

Standard Thermotomic:
Is generally used in dry and green sand molds. For Steel or Gray Iron castings.

Thermotomic WP (Waterproofed):
For use in green sand molds with any of the above metals including non-ferrous. Cores or inserts made of THERMOTOMIC WP may be left in green sand for several hours or overnight without absorbing moisture from the mold.

Thermotomic ABC:
For use in casting aluminum and magnesium. THERMOTOMIC ABC is more sensitive to heat reaction than any of the other brands of Thermotomic. It enters into exothermic reaction readily at the relatively low pouring temperatures. This exothermic reaction keeps the feeding metal liquid longer until the main body of the casting solidifies, thus eliminating the need of chills in many instances.

Soffel's Carbon-Free Liquidizer

Best results and maximum feeding can be obtained from Thermotomic when Soffel's Carbon-Free Liquidizer is used in conjunction with it. The liquidizer, when applied on the top of the feeding metal in all heads and risers, enters into an exothermic reaction which serves to heat the upper portion of the metal while Thermotomic ring core heats the metal in the lower portion. Carbon-Free Liquidizer also provides an insulating cover which further delays cooling. Other types of Soffel's Carbon-Free Liquidizers are available for conventional feeding heads and ingots. Note: With Thermotomic ABC, use Soffel's AL-X31 Liquidizer.

"Beware of Imitations"

We Are The Originators Of Carbon-Free Liquidizers

Pittsburgh Metals Purifying Co.

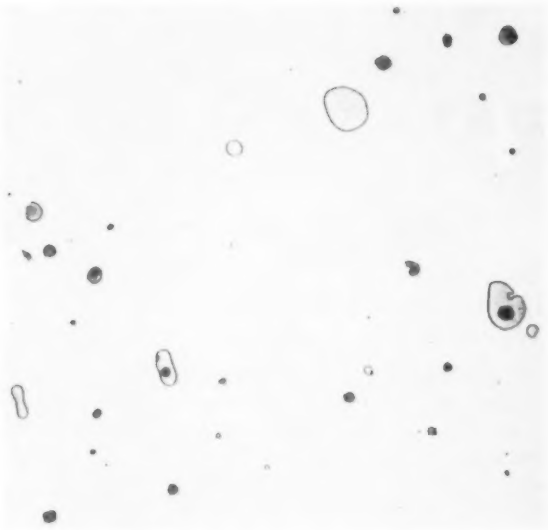
World's Largest Manufacturers of Fluxes and Purifiers for Ferrous and Non-Ferrous Metals

1352 Marvista St. N. S. **Pittsburgh 12, Pa.**

Determination of

SELENIUM in STAINLESS STEEL

By N. S. MOTT
Chief Chemist and Metallurgist
Cooper Alloy Foundry Co.
Hillside, N. J.



Showing steel gray, randomly distributed selenium inclusions in 18-8S type alloy. X500, as polished. (Courtesy Alloy Casting Research Institute)

THE difficulties experienced in obtaining reliable analytical results for selenium and its inclusion in the regularly obtained analyses for the stainless alloys made it clear that a simple, fast and dependable analytical procedure was urgently needed. Presented here is the method developed in our laboratory which has enabled us to control the presence of selenium with a high degree of accuracy.

Broadly speaking, methods for the determination of selenium can be classified as volumetric or gravimetric. Volumetric methods which may be mentioned are:

1. Iodometric procedures, in which selenic acid is reduced by hydrocholric or hydrobromic acids, the halogen caught in a solution of potassium iodide, and titrated with arsenite or thiosulfate.

2. Reduction by thiosulfate, in which a hydrochloric acid solution of selenious acid is reduced by an excess of a standard solution of thiosulfate that is afterwards titrated with iodine solution.

3. Oxidation of selenious acid by an excess of standard permanganate in sulfuric acid solution, followed by potentiometric titration with ferrous sulphate, or by the addition of a measured excess of oxalic acid and back titration with permanganate.

These volumetric methods, although accurate, are for the most part rather complicated, requiring a highly skilled chemist, and are not generally adaptable to rapid routine analysis as they require a preliminary separation of the selenium by filtration or distillation.

The gravimetric determination of selenium is based on its precipitation by various reducing agents in acid solution. Sulphur dioxide, hydroxylamine-hydrochloride, potassium iodide, stannous chloride, metals such as aluminum or zinc, and hypophosphorous acid are the precipitating agents, and hydrochloric the acid, most commonly used; however, all the reducing agents except sulphur dioxide and hydroxylamine-hydrochloride give reaction products which are occluded and therefore unsuitable.

For reduction by sulphur dioxide the selenium must be in the quadrivalent state and nitric acid must be absent. The sexivalent selenium produced in the solution of the sample by aqua regia is easily reduced to the quadrivalent state, after expulsion of the aqua regia, by heating with 30-40 per cent by volume of hydrochloric acid. To avoid selenium loss by volatilization the precipitating agent should be present at this time.

Since hydroxylamine-hydrochloride will directly reduce and precipitate selenium from the sexivalent state, it cuts down the precipitation time and is to be preferred. Its use also obviates the necessity of exposure of the analyst to noxious and irritating fumes resulting from the use of sulphur dioxide.

In the solution of the stainless sample it must be remembered that selenium is easily volatilized as $SeO_2{\cdot}2HCl$ from hot or boiling hydrochloric acid solutions and therefore aqua regia, preferably the 1-1 variety previously mixed, must be used. Selenium held in complex silicates is released by the use of hydrofluoric acid, which also assists in the solution of the sample and prevents precipitation of gelatinous silica during solution and after the subsequent fuming with perchloric acid.

Hydroxylamine-HCl Gravimetric Method

1. Dissolve a 5-gram sample of the drillings in a mixture of 30 cc of concentrated HNO_3 and 30 cc of concentrated HCl, adding about 2 cc of 48 per cent HF. After violent action ceases, heat gently until all is dissolved.

2. When in solution add 40 cc of 60 per cent $HClO_4$ and take to strong fumes.

3. Cool and dilute to 250 cc with hot water.

4. Next add simultaneously 20 cc of 25 per cent water solution of hydroxylamine-hydrochloride and 100 cc of concentrated HCl.

5. Digest on steam bath for one hour.

6. Filter in a Gooch asbestos-lined and ignited crucible, washing well with hot water.

7. Dry at 105° C for one hour, cool well and weigh.

8. Ignite to expel selenium, cool well and weigh.

The difference in weight is selenium, which weight, when divided by the sample weight of 5, times 100, gives percentage of selenium.

For selenium values under 0.10 per cent, treat two or more 5 gram samples as above and finally filter all on the same Gooch crucible.

REFERENCES

1. Sampling and Analysis of Carbon and Alloy Steels, Chemists, U. S. Steel Corp., Reinhold Publishing Corp. pp. 273-281.
2. ASTM Methods of Chemical Analysis of Metals, 1946, pp. 55-56.
3. Applied Inorganic Analysis, by Hildebrand and Lundell, John Wiley & Sons, pp. 258-266.

INDUSTRY Briefs

WARWICK MALLEABLE CO., Hillsgrove, R. I., which was formed in 1945 and which purchased the plant of Rhode Island Malleable Co., has closed permanently. Harry K. Taylor, formerly assistant treasurer and general manager of the firm, has joined the Albany Castings Co., Voorheesville, N. Y., as vice president and general manager.

* * *

Esselen Research Corp., Boston, Mass., has merged with the United States Testing Co., Hoboken, N. J., and is now known as the Esselen Research Division of the United States Testing Co. It will continue operations in Boston under the direction of Dr. Gustavus J. Esselen, its founder.

* * *

Precision Castings Co., 601 West Fayette St., Syracuse 1, N. Y., has purchased controlling interest in Reed Metal Crafts Inc., Chicago. The Reed firm, headed by Roe F. Reed, will continue operations as before. Precision also has affiliated with the Wolverhampton Die Casting Co., Wolverhampton, England, one of the largest commercial die casting firms in Britain or Continental Europe.

* * *

Lowell Iron Foundry Co., Saunders St., Lowell, Mass., suffered $50,000 fire loss when its pattern shed was destroyed Dec. 30. The fire was brought under control before damaging the main foundry, recently rebuilt after being levelled by a $300,000 fire about a year ago.

* * *

Ironton Fire Brick Co., Ironton, O., recently placed in operation a new specialty unit to increase the production of Ironton Berlite and Ironton Caro-Line. The company also plans a new unit for the production of Ironton Nojoint for desulphurizing ladles.

* * *

Cooper-Bessemer Corp., North Sandusky St., Mt. Vernon, O., has completed a plant addition consisting of two bays and making available 11,000 sq ft of floor space. Designed for flexible use in helping to eliminate production bottlenecks, the addition may be used for foundry molding, machining or welding operations, or for assembly of machinery subunits or complete engines.

* * *

Towmotor Corp., 1226 East 152nd St., Cleveland, manufacturer of fork lift trucks, tractors and accessories, has opened a factory sales and service branch at Fourth and Castro Sts., Oakland, Calif. Gordon Winters, formerly in sales supervision work in Cleveland, is in charge of the branch.

* * *

Mexico Refractories Co., Mexico, Mo., suffered damage estimated at $150,000 in a fire Jan. 2. Heavy production departments were not seriously affected, and partial operations were expected to be resumed in about two weeks. Full production is looked for early in February.

* * *

Interlake Chemical Corp., Forest Park, Ill., has been purchased by the newly formed Acme Resin Corp., which will continue manufacture of liquid phenolic resins at the Forest Park plant. The new management plans also to manufacture a phenolic core binder for foundry use.

* * *

Interstate Sales Inc., 817 Arcade Bldg., Eighth & Olive Sts., St. Louis 1, has been appointed representative in the St. Louis area for Geo. P. Reintjes Co., Kansas City, Mo., arch and wall manufacturers. Frank Weyforth is president of Interstate Sales Inc.

* * *

Chemalloy Foundry Inc., Louisiana, Mo., has acquired the Essco Mfg. Co., Piedmont, Mo., manufacturer of traffic signals. All operations will be transferred to the Chemalloy plant in Louisiana.

* * *

Indianapolis Stove Co., 1255 Roosevelt Ave., Indianapolis, suffered damage estimated at $15,000 in a recent fire which destroyed considerable machinery. Fire was confined to the blower room.

* * *

Driver-Harris Co., 201 Middlesex St., Harrison, N. J., manufacturer of special nickel-chrome alloys for electrical, mechanical and chemical uses, celebrated its 50th year in business on Dec. 23.

* * *

Lone Star Steel Co., 201 Cotton Exchange Bldg., Dallas 1, Tex., plans construction of a cast iron pressure pipe foundry to be completed and in production by August.

* * *

Acme Foundry, Eureka, Calif., suffered $50,000 fire loss Oct. 7. Lynn Victor is owner.

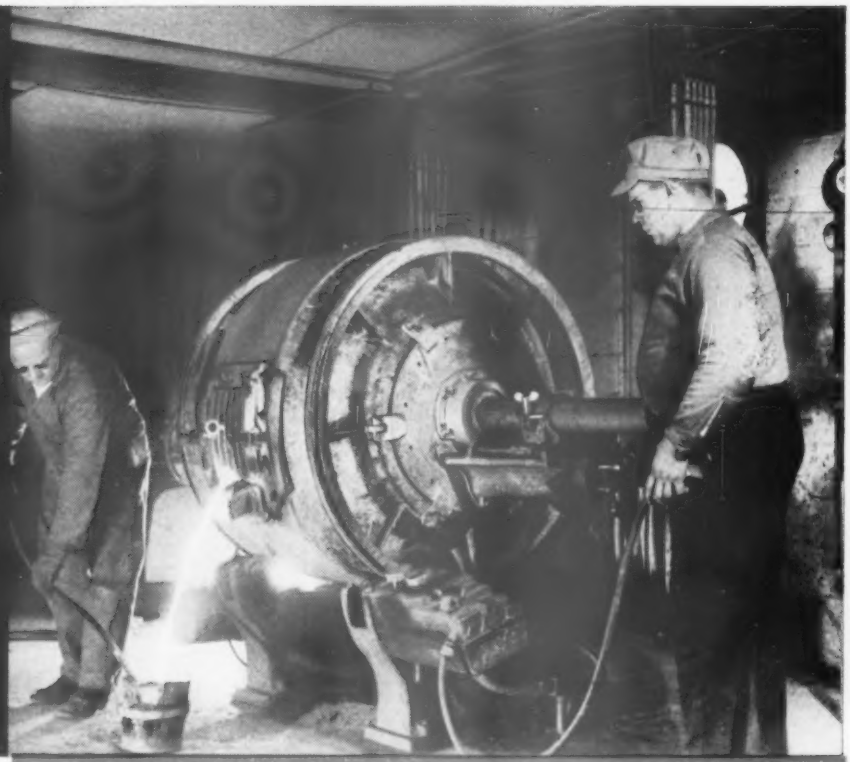
AUSTRALIAN FOUNDRY: Construction and staffing of this new gray iron foundry of General Motors Holden's Ltd., Melbourne, Australia, was supervised by Harry G. McMurry, assistant superintendent, Pontiac Motor Co., Foundry Division, Pontiac, Mich. The Australian foundry furnishes all castings required for the Holden automobile now being built there. Operations embodying all the principles of the largest automotive gray iron foundries in the United States were scaled down to the requirements of an 85-cars-a-day production schedule. Orders are booked for two years' output

No pigs

in 168,930 lbs. of synthetic alloy iron

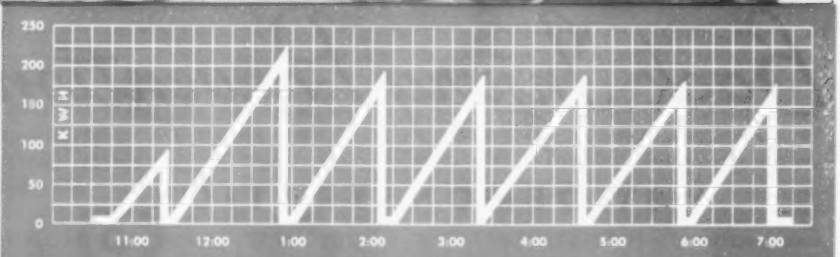
●

A DETROIT ROCKING ELECTRIC FURNACE Melts Scrap with Economy and High Uniformity



No pigs were used in the production of 168,930 lbs. of uniform quality synthetic alloy iron by the Detroit Rocking Electric Furnace shown above. All charges were of scrap and graphite only.

Big savings were made on raw materials. Melt quality and homogeneity were rigidly maintained by automatic control.



One month's operation of type LFY, 175 KW, 700 lb. nominal cold charge capacity Detroit Rocking Electric Furnace. High strength, alloy automotive irons poured at 2800-3000° F.

● No. heats per day—7 ● Av. heat weight—1000 lbs. ● Total lbs. cold melted—168,930 ● Av. power consumption, including preheat—549 KWH/ton ● Total average cost for power, refractories, and electrodes, $11.41/ton.

NOTE: *Operator handles two such furnaces all day. Furnaces are equipped with automatic electrode control as well as automatic rocking control.*

Get Multiple Savings

In your melting operations, you'll achieve better castings, fewer rejects, higher usable yields with Detroit Rocking Electric Furnaces. Faster melts mean more heats per day.

Because the electrodes are always clear of the molten bath, carbon pick-up is eliminated. Indirect arc and automatic electrode adjustment result in optimum power use. All-electric operation excludes costs of handling and storing bulky fuels. Control of interior atmospheres assures peak quality.

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Increase YOUR Profits!

Whether you melt ferrous or non-ferrous metals, Detroit Rocking Electric Furnaces will give you top melting economies. Send us your production data. Our engineers will furnish facts on how you benefit through better quality control, greater production, with Detroit Rocking Electric Furnaces. Available with conical or cylindrical chambers, in capacities from 10 to 4000 lbs. Write, now, to:

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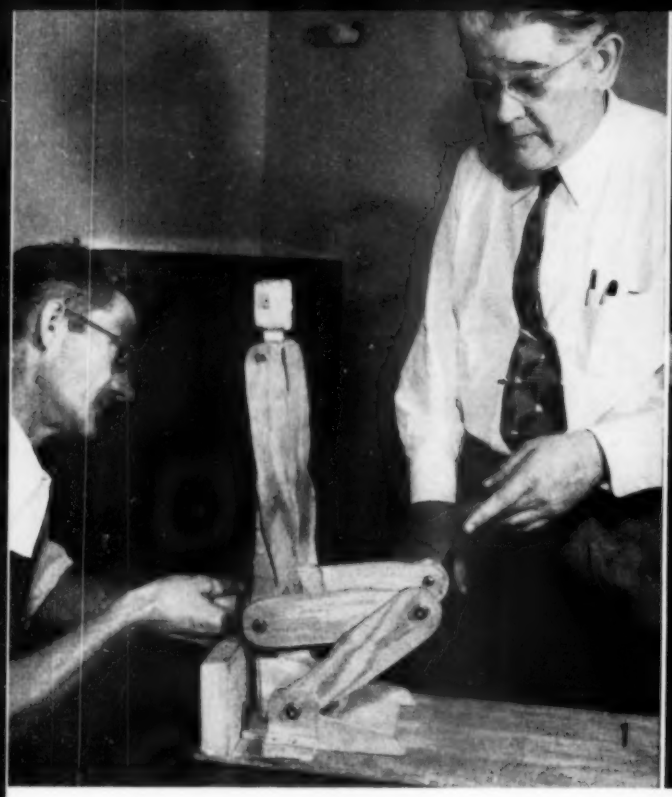
KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

Foreign Representatives: In BRAZIL—Equipamentos Industrias "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Casco, S. de R. L. Atenas 32, Despacho 14, Mexico City, D. F.



Demonstrating by means of a model the correct way to lift a load. Fig. 1 — Load is close, back is straight, knees are bent. Fig. 2—The lift is made safely

Back Injury Prevention

BY DEMONSTRATION

By WILLIAM R. BLEWETT
Westinghouse Elect.ic Corp.
Baltimore

A SURVEY of medical records at our plant revealed that 40 per cent of our accidents resulted from improper handling of materials and that 14 per cent of the total were from lifting strains, affecting either the back or the abdomen.

We approached the question of handling materials through special attention to piling and transportation methods; a special course of instruction, of eight one-hour sessions in use of cranes, chains, slings and the duties of crane hookers. But still the percentage of strains from lifting remained high and the safety committee, after deliberation, devised a special drive on safe lifting.

We have a particular liking for these special campaigns. Through the years, we have learned that they are stimuli to spirit, and they serve to increase the momentum of the safety program. We know, too, that they must be handled right. A special drive must not only increase but must maintain the momentum; there must be no slackening off of the interest afterward, or the safety program in the minds of everybody will come to mean a thing of stout sporadic efforts in isolated fields, instead of a necessary, regular and constant part of daily working life.

We have found, too, that the special drive is a means of getting supervisors and check employees working together on a common project, that it builds co-operation, and a greater degree of mutual esteem. Further, we have learned that a man's interest in a project will be in direct ratio to his sense of responsibility for it; and the larger the responsibility given a man, the more he values the movement or project which gives him not only responsibility, but an increased self-esteem. A campaign such as this one gives us opportunity to apportion responsible functions to many people.

The safety committee created a special campaign group which included the membership, plus 16 safety observers. The observers were given a special course of instruction, six weekly sessions of one hour each. The course made use of safety-graphs, charts on medical history as related to lifting, sound-slide films, and practical demonstrations of lifting the common items of our ordinary operations, such as base castings, transformers, etc.

We also made use of a mechanical fixture, illustrated here, which demonstrates how the strain of a wrong lift affects the muscles of the back and abdomen. This made an immediate hit with the group, and continues to do so wherever it is shown. It will be noted that in the simulated tote

The wrong way to pick up a load. Fig. 3—Load is extended, back is bent, legs are straight. Fig. 4—Lifting puts undue strain on back and abdominal muscles

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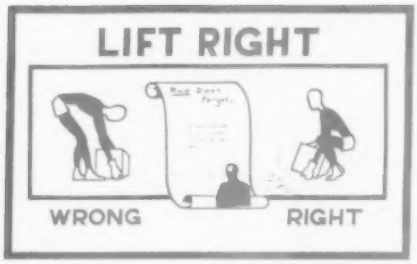

Above — Special poster used to promote interest in correct lifting. It includes photographs of workers demonstrating the incorrect (Fig. 5) and the right (Fig. 6) lifting methods

6

pan there is a 1-pound lead counterweight. When Oscar, as our dummy has been named, approaches a lift properly—that is, by crouching rather than by stooping, by keeping his back straight and bending his knees, and by keeping the load close to him —he can lift without injuring himself. But when he lifts as so many people do —with the load far away, his back bent over, and his legs straight—he can lift it, but he strains his back muscles and his abdominal muscles and, of course, damage often results.

After the course of training, the observers were sent out onto the floor to carry the message to their fellows. Oscar was circulated among them, and we found that everyone wanted to make Oscar work—and everyone learned a lesson from him.

To support the activity of these observers, we prepared a special poster. This poster had a general message with figures showing the proper and improper methods of lifting. It also contained a blank scroll in the center, headed: "And Don't Forget—." In this space we added slogans and instruction turned in by the workers on the floor. The particular poster shown here bears the message: "And don't forget that a lifting strain can hurt your pocketbook as well as your back." It was signed by the suggestor, Joseph Baker of the maintenance department, and his photograph is attached to it.

The personalization of the posters awoke great interest among workers, who showed a surprising desire to have their names, messages and photos posted in the plant.

It serves another purpose too: These suggesters committed themselves to a policy; and since then, we do not often have to remind them that they have a responsibility for safe lifting on their own part, and also on the part of their fellows.

This poster was economical, since one printing and one posting not only had the attention-getting features a poster should have, but also it had the attention-holding feature of the diverse messages and photographs, which meant that workers would look at and read not only one posted placard, but would read each one he saw. The repeated registration did no harm.

Another use of the same poster was to use photographs of our workers demonstrating the incorrect way of approaching a lift, and the correct way of making it. These were posted over the artists' drawings of lifting workers, and served as an additional interest-getter. With fifty workers sending in slogans and fifty more making demonstrations, and fifteen or twenty observers fostering Oscar in their sections, a larger plant than ours can be thoroughly saturated with the cadenced slogan, "Lift Right."

It is too soon to say what the net results will be, but an empiric opinion based on the reaction we have observed, leads us to be hopeful that great good will be accomplished. I can illustrate this by an incident that occurred three months after the campaign started. A material handler stooped over a tote pan of piece parts. He was not doing it right. The safety man in the group called: "Hey there—Lift Right." The cadenced slogan was picked up, and for several moments echoed throughout the shop. So I vote the boys a bouquet, for remembrance.

Book Review

Structure and Properties of Alloys, second edition, by R. M. Brick and Arthur Phillips, cloth, 485 pages, 6 x 9¼ inches, published by McGraw-Hill Book Co., New York, price $6.

Developments in the field of physical metallurgy during the past decade have necessitated additions to this volume which nearly doubled its size. The general approach of the first edition has been retained but new alloys and techniques now proved of engineering merit have been considered worthy of inclusion or expanded treatment.

The work deals with commercially pure metals, solid solutions, cast eutectic alloys, age hardening of cast and wrought aluminum alloys, alloys of magnesium, phase transformations, iron-carbon alloys, theory of heat treatment of steel, carbon and alloy tool steels, special corrosion and heat resistant alloys, cast irons, and sintered metal powder.

Die Casting Award Program Set Up

American Die Casting Institute, 366 Madison Ave., New York 17, has set up an award program designed to stimulate advancements in the die casting industry. Made possible through a donation by the Doehler-Jarvis Corp., New York, the program provides for a cash award of at least $500 and an appropriate plaque, to be presented each year to an individual or related group making the most noteworthy contribution in technical achievement, advancement in plant operations or activity in the field of public relations.

The institute's board of directors will select award winners from nominations by the industry, technical societies, universities, government bodies and related trade associations.

Entries must be submitted each year between Jan. 1 and Apr. 1. The first award will be made at the annual meeting of the institute, in Sept., 1950.

15 New POWER SIZES

Controlled Power Hammers

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You can lower *your* costs of chipping the new and tougher metals now being cast, forged and welded and at the same time make your hammer operator's job easier.

For the first time, you can select from a complete set of 15 graduated power hammers, the tool to match accurately the choice of each one of your operators for the hammer to do his particular job.

This outstanding achievement is obtained by a design variation in one part which is completely interchangeable throughout the line...a flexibility of design which gives you a choice of 15 chipping hammers where only 5 existed before...now you have 5 basic hammers in each of the following three power groups...*normal cut, extra cut* and *super cut.*

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BUY IT THAT WAY...

Here's your chance to try this new Controlled-Power Chipping Hammer in your own shop on your own metals. The results will enable you to determine what replacements will be profitable.

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Gentlemen: We are interested in cutting our chipping costs and making the operator's job easier.

☐ Send descriptive folder on new Controlled Power Hammer.

☐ We would like to try a hammer in our shop.

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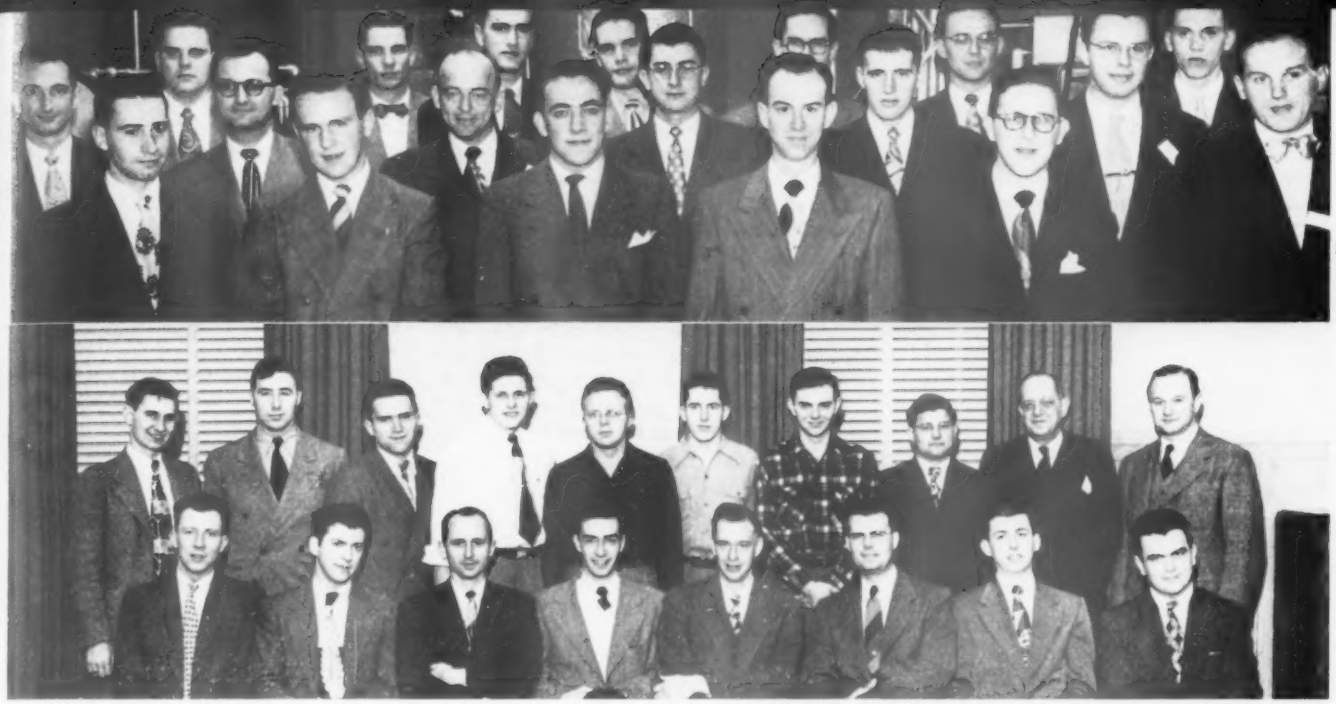


FOUNDRY EDUCATIONAL FOUNDATION SCHOLARSHIP HOLDERS: University of Wisconsin FEF scholarship students are shown in top view. Front row, left to right, are: Allen B. Beach, Edward G. Gibson, William A. Schrader, Joseph R. Vinette, Gerald Tannenbaum and Paul J. Mikelonis. Second row: Frank J. Lisi, Prof. Richard W. Heine, Gilbert E. Kempka, George J. Wagner, and John L. Flitz. Back row: Edwin D. Baugh, Richard T. Voelz, Henry R. Bergmann, Richard C. Beaman, Peter O. Kirchhoff, William A. Gloe, and Theodore R. Weins. Lower photo is of FEF scholarship students at Case Institute of Technology. Front row, left to right, are: Fred Karpoff Jr., Ray H. Witt, John Varga Jr., Frederick F. Awig, William L. Griffith, William J. Parana, Forrest E. Fisher, and Henry Kopczewski. Back row: James J. Reymann, Alton W. Bardeen, Robert J. Unger, Peter J. Petto, Robert W. Lundberg; Frank C. Nelson; Daniel F. Mika; Patsy A. Santoli; Walter L. Seelbach, chairman, Case Advisory Committee, FEF, and George K. Dreher, executive director, FEF. Students not shown in the photo are: Jerry D. Hix and Elliott H. Morris

FOUNDRY EDUCATIONAL FOUNDATION CAMPAIGN

Forges Ahead in Drive for Funds

FUND campaign of the Foundry Educational Foundation is well under way. The drive for finances to support the foundation's program for the three years starting next May 1 enlisted 284 pledges for $165,189 as of Jan. 6. The contributors include 123 new members and 161 continuations of present memberships.

This campaign is directed toward an ultimate membership of 1000 companies. An original list of more than 6000 foundries, equipment and supply companies was reduced to 3876 through selection by local campaign chairmen, and these potential foundation members now are being contacted by the FEF campaigners.

Paralleling the financial campaign, the work of placing students for both permanent and summer positions this year also is progressing. As of Jan. 5 a total of 114 graduating engineers were registered as prospective foundrymen, and 94 summer work candidates had expressed their desire to obtain further plant experience. Of the graduating group, 53 are either scholarship students or those who have voluntarily elected the recognized foundry courses in their university. They represent the first sizable group of young men with pre-established interest, experience and education in the metal casting field.

FUND CAMPAIGN AS OF JAN. 6

	Pledges To Date	
	Number	Amount
Cleveland	51	$33,710
Detroit	28	28,305
Chicago	12	21,186
Cincinnati	19	15,430
Birmingham	9	10,334
Buffalo	29	9,490
St. Louis	22	8,281
New Haven	15	6,143
Milwaukee	13	5,648
Columbus	12	4,711
Indianapolis	17	4,216
Philadelphia	5	3,333
South Bend	1	3,000
Newark	8	2,285
Syracuse	14	2,250
Rockford	6	2,025
Minneapolis-St. Paul	8	1,096
Peoria	2	1,025
Mail	2	850
Muskegon	1	750
Davenport	6	560
New York	2	301
Baltimore	2	260
Boston	..	....
Erie	..	....
Pittsburgh	..	....
Total	284	$165,189

A booklet listing those students now available to the industry has been forwarded to the FEF membership. A second booklet listing the June graduates will be mailed Feb. 1 and will be supplemented by those registrations received up to Mar. 15. Prior to Mar. 15 an abridged listing of summer work candidates will be forwarded to the industry.

Each member of the industry is being urged to visit one or more of the foundation universities to become acquainted with the students available and the training program developing in those schools. The FEF points out that the young men who have entered the industry the last two years have established their value to their companies, and one of the best ways to become acquainted with their potentialities is by actual

visits and interviews.

To assist in arranging these visits the FEF has published a directory of key personnel in each of the FEF schools, as well as a check list of staff and supervisory positions for which training is required.

Some of the graduating engineers from two of the seven FEF schools are included in the accompanying illustrations of the scholarship groups at the University of Wisconsin and Case Institute of Technology.

OBITUARY

EUCLID E. GRIEST, 67, vice president-general manager, Lehigh Foundries Inc., Easton, Pa., died Dec. 25. Mr. Griest, a native of Zanesville, O., began his career in 1907 as a designing engineer for Crucible Steel Co. of America, Pittsburgh. He worked for the Erie and Pennsylvania railroads and was general superintendent and later vice president of the Chicago Railway Equipment Co., Chicago, from 1918 to 1936. From 1936 to 1940, he was vice president and general manager, Fort Pitt Malleable Iron Co., Pittsburgh, when he joined Lehigh Foundries.

* * *

C. D. Hollins, 63, who as C. D. Hollins Foundry Equipment, Chicago, served as manufacturers representative for several lines of foundry equipment, died Dec. 25 in that city. Among the companies he represented were National Engineering Co., Chicago; Royer Foundry & Machine Co., Kingston, Pa.; Cannon Vibrator Co., Cleveland; and Whiting Corp., Harvey, Ill. His son, D. K. Hollins, who has been associated with the business, will continue representation of the latter three manufacturers.

* * *

Harold J. Deutsch, 60, vice president and a director, Monarch Aluminum Mfg. Co., Cleveland, died Dec. 24. In 1913, with his brother, Raymond Deutsch, he founded Monarch Aluminum Ware Co., and had served as vice president since shortly after the company's incorporation under the present name. Mr. Deutsch, a pioneer in the aluminum foundry industry, was active in the management of the company for over 36 years.

* * *

Walter A. Janssen, industrial consultant, who retired in July from the Department of Commerce, died Dec. 18. Mr. Janssen, a graduate of University of Wisconsin, following 16 years in the steel casting industry and 13 years as private industrial consultant in Chicago and Pittsburgh, became chief of the Metals and Minerals Division, Bureau of Foreign and Domestic Commerce. In recent years he had served the department as consultant on iron and steel, nonferrous metals and minerals, and worked closely with War Production Board and other government units.

* * *

Charles E. Schley, chairman of the board of directors of the Philadelphia Bronze & Brass Corp., Philadelphia, died Dec 9. Mr. Schley, a leader in the nonferrous foundry industry, served for many years as a director and as a member of the executive committee of the Non-Ferrous Founders' Society, as well as being co-chairman of the organization's Philadelphia Chapter.

* * *

William E. Brewster, 60, who retired Jan. 1, 1949, as manager of operations, Wisconsin Steel Division, International Harvester Co., Chicago, died suddenly Dec. 19. He had just recently returned from Europe where he was special technical consultant on steel plant operations for the U. S. Military Government in Austria.

* * *

John F. Skube, 61, retired foreman of the pattern shop, Pacific Car & Foundry Co., Seattle, died Dec. 10 at his home there. Mr. Skube, a native of Austria, came to United States 50 years ago. He had been associated with Pacific Car & Foundry Co. for 25 years and retired last August.

* * *

William H. Hoppenjans, 64, president, Star Foundry Co., Covington, Ky., died there Dec. 24. A native of Covington, he joined Star Foundry Co. in 1904, as office assistant and in 1913 became a director and company secretary. He was elected president in 1927.

* * *

William M. Collins, 68, retired foundryman of over 51 years of service, died Dec. 25, at his home in Milwaukee. A native of St. Louis, Mr. Collins went to Milwaukee in 1901, and spent 23 years at the Sivyer Steel Casting Co. there, as a chief inspector.

* * *

William F. Campbell, 58, vice president, McKiernan-Terry Corp., New York, died Nov. 19. Mr. Campbell was secretary of Campbell Foundry Co., Harrison, N. J.

* * *

Harrison Hoblitzelle, 53, since 1945 chairman of the board of directors, General Steel Castings Corp., Granite City, Ill., and Eddystone, Pa., died Dec. 5, at his home in Ithan, Pa. Mr. Hoblitzelle, a native of St. Louis, and a graduate of Cornell University, was for many years an officer of Commonwealth Steel Co., Granite City, Ill. before it was absorbed in General Steel Casting Co.

* * *

John Tracy, 82, president, Salmon Bay Foundry Co. Inc., Seattle, died there Dec 6. Mr. Tracy was born in Greenock, Scotland and left there in 1898 to join the Alaska gold rush. He went as far as Victoria, B. C., moving a year later to Seattle. He had been associated with Salmon Bay Foundry since 1914.

* * *

Herbert Larson, since 1927 foundry superintendent, Minneapolis-Moline Co., Minneapolis, died Nov. 20. Mr. Larson entered the foundry of Gillette & Eaton, Lake City, Minn., in 1900. In 1919 he joined Minneapolis-Moline Co., and became foundry foreman three years later.

* * *

Homer F. Rosback, 49, president, Fay Foundry & Machine Co., St. Joseph, Mich., died Jan. 7. Mr. Rosback was also president and general manager, F. P. Rosback Co., Benton Harbor, Mich., manufacturer of perforating and stapling equipment for the printing industry.

* * *

Erwin Doerschler, 56, partner and president, U. S. Foundry Corp., Kalamazoo, Mich., died Jan. 11, in University Hospital, Ann Arbor, Mich., following an illness of 3 weeks. A native of Germany, Mr. Doerschler had lived in the vicinity of Kalamazoo for 24 years.

* * *

William F. Ward, 65, formerly superintendent, Kennedy Valve Mfg. Co., Elmira, N. Y., died Dec. 14. Mr. Ward had been associated with the company for more than half a century, holding various executive posts.

* * *

George W. Tyler, 64, for the past 15 years traffic manager, Chevrolet-Saginaw Gray Iron Foundry, Saginaw, Mich., died Dec. 13.

* * *

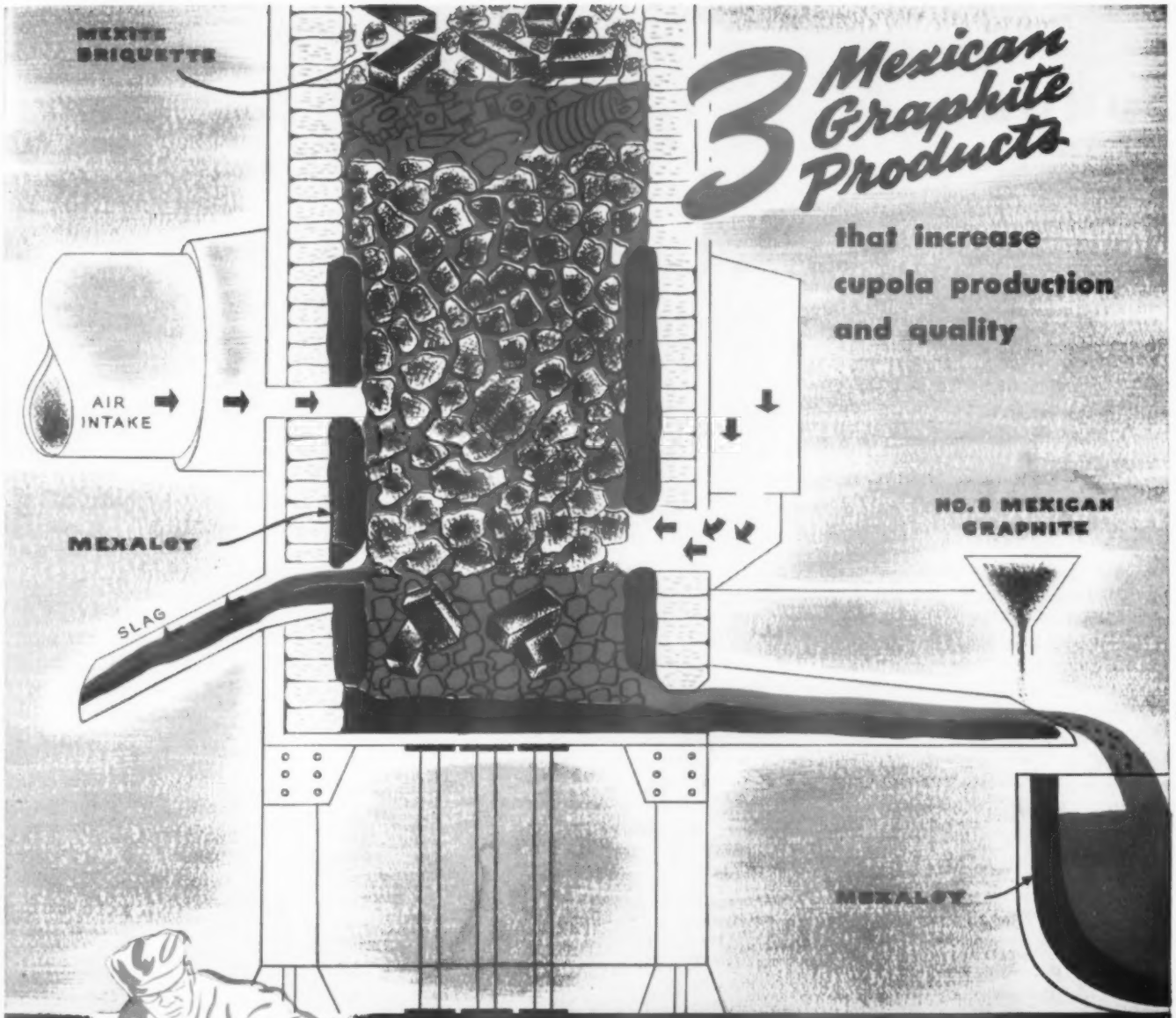
Stephen C. Cheney, 67, president, S. Cheney & Son, Manlius, N. Y., producers of gray iron and aluminum castings, died Jan. 5.

* * *

Edgar C. Sanders, 50, vice president, American Foundry & Mfg. Co., St. Louis, died Dec. 18 at his home there.

* * *

Albert R. Kluge, 53, foundry superintendent, Fuller Mfg. Co., Kalamazoo, Mich., died Nov. 30.



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DIVISION OF THE WICKES CORPORATION

By EDWIN BREMER

FOUNDRY Developments

OBTAINING a really dry ladle for use in pouring steel or iron requires high temperature, as indicated by some data presented in a paper "Melting Practice on Hydrogen" by Sam F. Carter Jr., and given at the recent Electric Furnace Steel Conference. In the study described three ladles were used. One was subjected to a drying operation of 3 hr to 500° F, to 800° in 16 hr, and 6 hr to 2380° F. The second was heated for essentially the same period of time, but at a much higher temperature level; the cycle including up to 1600° in 4 hr, 1600 to 2000° for 13 hr, from 2000 to a maximum of 2800° in 5 hr. Third ladle was pushed up to 2000° F in 1 hr and to 2400° in 3 hr. First ladle showed a pickup of 0.07-relative volume of hydrogen, the second gave no pickup while the third showed an increase of 0.02-relative volume, a negligible increase since the steel originally contained only 0.09-relative volume.

* * *

IN CONNECTION with investigations in the field of x-ray strain measurements, John A. Bennett, National Bureau of Standards, has developed a photomicrometer which has several advantages in measuring diffraction patterns. New instrument is designed for measuring patterns directly. Calibrating ring of known inside diameter is recorded on the film immediately after the diffraction ring, and the radius of the diffraction ring is determined by measuring its distance from the inside of the calibrating ring. Apparatus is a densitometer with a dial indicator to measure movement of the film. Use of the new instrument has saved 15 to 20 minutes per pattern.

* * *

PROCEDURE for removing aluminum from copper-base alloys is described in an article by V. Larsson in the December, 1949 issue of our Swedish contemporary *Gjuteriet* (Stockholm). A number of fluxes, including proprietary materials, were tried, and the following gave good results: One is composed of 7 parts by weight of calcium fluoride, 2 parts sodium sulphate and 1 part sodium carbonate. The other contains 3 parts sodium fluoride, 2 parts calcium fluoride, 2 parts sodium aluminum fluoride (cryolite), 2 parts sodium sulphate, and 1 part sodium carbonate. Flux must be kept dry. Copper-base alloy to be treated is heated to 100° C (212° F) above its liquidus temperature, and 1½ per cent by weight of the flux added and stirred in well. It is claimed that the aluminum content can be reduced from 0.3 to 0.01 per cent in 10 minutes.

* * *

TO OBTAIN liquid steel samples or specimens which would be free from slag, Surahammar Bruks AB, Surrahammar, Sweden, uses a mild steel spoon or mold with a wall thickness of 0.4-in. which provides a tapered specimen about 3.2 in. high, 1.6 in. in diam at the top and 0.8-in. in diam at the bottom. The mold or spoon is covered with a thin sheet steel lid 0.5-mm (about 25 gage) thick. The lid in turn is covered with a wood block about $1\frac{5}{16}$ in. thick which is wired on. In practice the spoon is slagged up to the edge, and then dipped into the steel bath beneath the slag covering. When the wire melts, the wood block floats to the surface, uncovering the slag-free steel lid. The lid then melts and the spoon or mold is filled with steel.

* * *

THOSE interested in applying insulating sleeves, neckdown cores, etc., but cannot use gypsum due to its sulphur content might try diatomaceous earth. Puget Sound Naval Shipyard uses the following mixture: 3¾ lb diatomaceous earth, 12 oz bentonite, 1 pt resin (160 grams synthetic resin and 240 grams alcohol), and 2 qt water. Materials are mixed in a small muller, and resulting material is plastic and can be formed to desired shape. It is dried for 1 to 4 hr at 400° F after shaping.

* * *

BRITISH manufacturer of an automatic molding machine which performs the various operations of jolting, squeezing and lifting through use of a rotary sleeve valve now is engaged in integrating an automatic sand filling system with the machine, according to *Foundry Trade Journal*. Sand filler is a hopper with a motor-driven belt feeder. When completed all the operator will have to do is push a button, whereupon the flask will be filled with the proper amount of sand, the flask jolted and squeezed, and then lifted from the pattern.

* * *

INFORMATION presented in "Influence of Low Temperatures on the Mechanical Properties of 18-8 Chromium-nickel Steel," by D. J. McAdam Jr., G. W. Giel, and Francis J. Cromwell, indicates that six strength indices are sometimes required to evaluate the mechanical properties of these steels. These are: Yield strength; first ultimate stress; stress at reversal in the load-extension curve; stress at minimum in the load-extension curve; second ultimate stress, and true fracture stress. Complete data are available in National Bureau of Standards, *Journal of Research* 40, 5, RP 1882.

* * *

REPORT in *Ferrous Metal Industry in Germany During the Period* 1935-1945 states that one German foundry producing "blackheart" malleable iron consistently, added aluminum to the ladle with the dual object of deoxidizing and shortening the annealing process. Amount was 5 grams per 50 kilograms of metal or 0.01 per cent. This appears a practical application of the results described by Richard W. Heine in two articles on "Deoxidation of White Cast Iron" which appeared in the August and September, 1949, issues of THE FOUNDRY.

* * *

CERAMIC material which contracts when heated and expands when cooled is being evaluated by Air Force engineers who believe it may find a wide range of uses in jet engines. Known as "stupalith", the new substance is a lithium aluminosilicate processed to develop beta-spodumene, with excess silica molecules forming a solid solution with the beta-spodumene. It can be formed and shaped by conventional methods of pressing, extruding and casting.

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Casting Centrifugally in
GRAPHITE MOLDS

By JOHN PUTCHINSKI
Allis-Chalmers Mfg. Co.
Milwaukee

Above—Two small scrap rods machined to make a single long casting

EXTENSIVE use of centrifugal castings is made by Allis-Chalmers in the production of over 1600 different items of major industrial equipment.

Electric furnaces and seven casting machines turn out an average of 40,000 lb a month. The bulk of this work consists of shaft nuts, shaft sleeves, impellers for pumps, baffle ring blanks for steam turbines, and male contacts and stubs for electrical equipment; castings varying widely in geometric design. Although our centrifugal casting department specializes in non-ferrous work, it nevertheless takes advantage of the versatile electric furnace which, beside melting brasses and bronzes, also melts down ferrous metal such as steel and cast-iron.

Left—Typical castings made by centrifugal casting. Most of these were made in graphite molds

Below — Operator inserting a graphite mold in a centrifugal casting machine. This mold is for an aluminum-bronze shaft sleeve

For our varied operation, graphite rod has proved a very desirable mold material. Its value is demonstrated in lightness, easy machinability, high heat conductivity, and low coefficient of expansion. For nonferrous casting it is our experience that no other material compares with graphite rod in economy for production runs up to 500 pieces. From 50 to 280 castings can be made from an individual mold depending on size, shape, and metal.

In actual practice, the machined graphite rod is inserted into a die holder. Since a 1-in. mold wall thickness is preferred for good production, standards for the outside diameter have been established to conform with the rod manufacturer's specifications. For use in our foundry, 6, 10, and 14-in. OD rod is purchased. The die holders are approximately ¼-in. smaller than the rod and the rods are turned down to fit them, to take care of any irregularities which may occur in rod diameter and to promote better balance in the spinning machine.

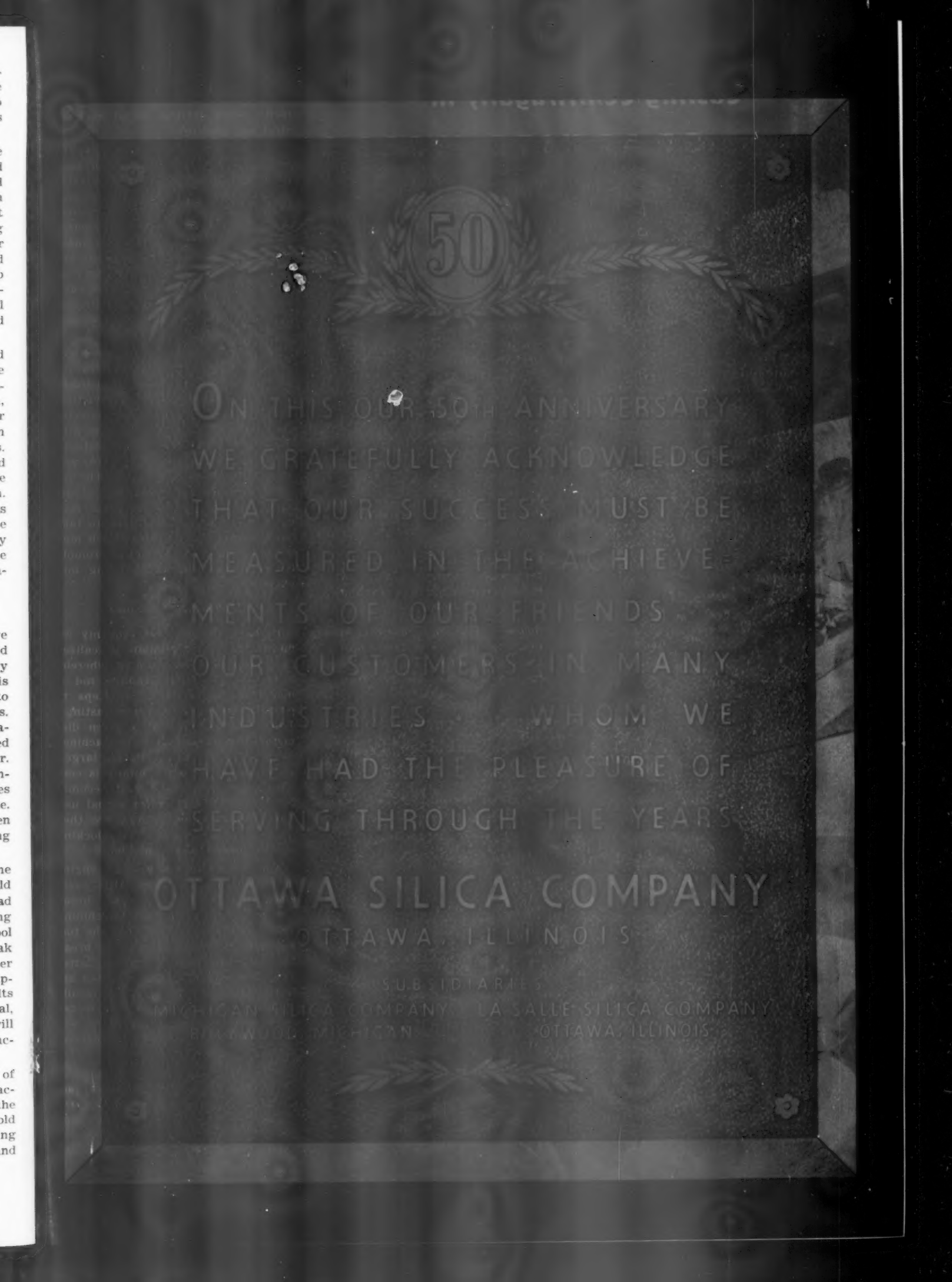
Molds Are Machined

Perhaps the greatest economy we find in the use of graphite is realized by good production planning, whereby a mold made from graphite rod is machined larger in ⅛-in. steps to produce successively larger castings. Thus after a mold of a given diameter is worn out, it is re-machined to produce a casting ⅛-in. larger. This process of re-machining is continued until the mold wall becomes too thin or too short for actual use. These worn molds or dies are then used in our foundry for blocking shorter molds in the die holder.

For machining we use an engine lathe, although a wood lathe could also be used. In either case broad cutting tools and high machining speeds are preferred so that the tool will cut rather than tear or break the graphite grain. In the latter case broken grain gives a pitted appearance to the mold which results in poor performance, since the metal, influenced by centrifugal force, will fill these pits and hinder the extraction of the casting.

Our decision as to the amount of taper is influenced by several factors, such as wall thickness of the castings in proportion to the mold thickness, the length of the pouring cycle, the machining standards, and

(*Concluded on page* 135)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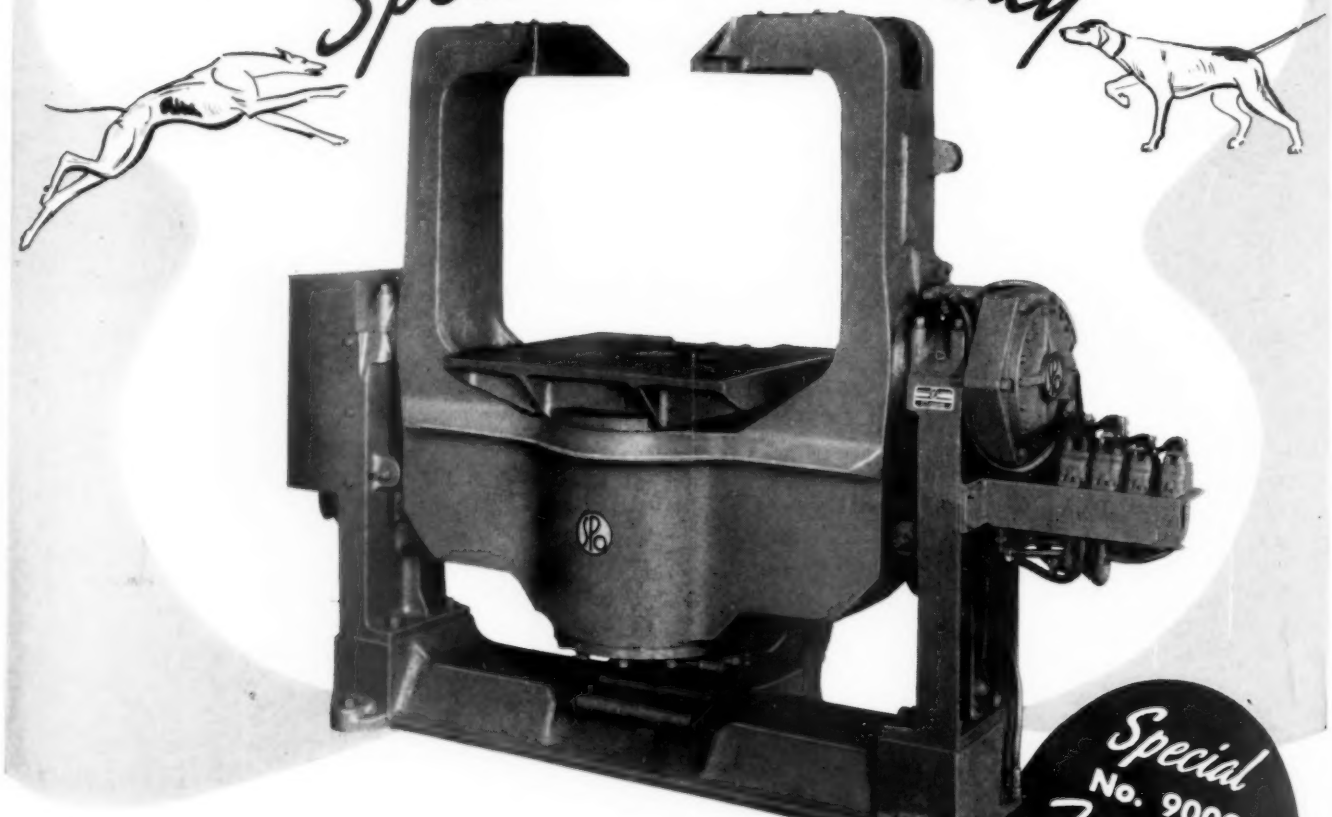

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(*Concluded from page* 132)

the shrinkage factor of the metal. The normal taper allowed is 3/16-in. to the foot, except when, to facilitate removal of low shringage metal, ¼-in. may be used.

Mold temperature of graphite, as with permanent molds, has a definite influence on the stock allowed for machining. With an experienced workman carefully controlling metal temperature, as little as 1/64-in. stock is required on the side.

The metal temperature and pouring cycle also influence the wall thickness of the die or mold. A 1-in. wall is desirable but as little as ¼-in. may be used. With a thin wall, special care must be taken to see that the mold fits snugly into the die holder. Should there be any play in the fit of the mold, the centrifugal force of the metal will not only cause a casting to be eccentric, but may also crack the mold and cause a hot tear in the casting.

Preheat the Mold

We generally find it desirable to preheat the mold before pouring, primarily for finish on the casting. On occasion, the first casting poured may be used as the preheat operation while in other instances the very first casting may be suitable without preheat. We find graphite rod can effectively be used up to about 500° F. As the pouring temperature rises, mold life is proportionately reduced. But, special requirements may warrant higher temperature without regard for mold life. Graphite molds have been used for all types of nonferrous and many types of ferrous metal. Stainless steel has been poured against graphite rod with little or no carbon pick-up. We have poured various grades of steel castings weighing from 60 lb to 170 lb each, with much success. Graphite has also been an effective mold material for cast iron.

The use of graphite rod at Allis-Chalmers widens daily in scope. Originally used only for electrodes in arc furnaces, and as brushes on electric motors, it has found many other applications in the casting field, such as pin cores and bolt cores. In castings where cores burned in or were reduced to silicates because of terrific pressure and temperature, graphite rod has been found to keep its shape and to be easily and cleanly removed. Graphite rod is used as runner gates, and in special applications it is inserted in molds to prevent washouts or to help hold cores in place. The mild chill effect on castings warrants its use for set cores. In these applications the graphite is not reusable. Other familiar uses of graphite in casting are for pouring basins and for skimming and stirring rods.

Reproduced from *International Digest* of the International Graphite & Electrode Corp., St. Marys, Pa.

Flasks and Rigging

(*Continued from page* 99)

necessary to set plates on the sand between the cope bars, and wedge them firmly against binders tied across the top of the mold.

There is another case in which the lifting force of the metal on the cope must be taken into consideration. That is when the steel gets into the space between cope sand and drag sand because of a bad joint. Even a thin layer of steel, of course, exerts a tremendous lifting force under these circumstances, and if the mold is not tied down strongly enough, the cope may rise and allow the metal to run out to a serious extent.

In the case of the casting shown in Fig. 19, there is 1 ft of sand around the mold cavity, and the area of the joint is 23 sq ft or 3312 sq in. At 17 ft below the surface of the steel, the pressure is 17 x 3.1, or 52.7 psi. Should the steel cover the entire joint, even for a moment, the lifting force would be 3312 x 52.7, or 174,542 lb. Each of the eleven 18-in. deep flask sections would weigh about 5600 lb and contain some 3450 lb of sand. The combined weight of the cope would therefore be 99,000 lb, leaving an unbalanced lifting pressure of 75,542 lb. To resist this pressure would require four tie-rods each about 1 13/16-in. in diam, or eighteen 7/8-in. diam bolts.

In contrast to the pressures on molds, which vary directly with the depth below the surface of the liquid metal, the forces tending to lift cores are the same, regardless of how far below the surface of the metal the core is located. A submerged body, such as an interior core, is acted upon by a force equal to the weight of the volume of liquid it displaces, so that a core with a volume of 1 cu ft is under a lifting pressure of 440.6 lb, minus its own weight. A cubic foot of rammed sand will weigh about 100 lb, to which must be added a certain amount for core rods or arbors, so that the lifting force on a core of 1 cu ft volume is not far from 300 lb.

There is no lifting force on a core at all, it must be remembered, unless there is metal under it as well as against its sides and top. Thus a core of cylindrical or pyramidal section, set on end in the bottom of a mold, and extending upward into the liquid steel does not tend to rise at all, so long as no metal gets into the core print. If such a core is larger at the upper end than at the bottom, part of the pressure on its sloping sides tends to make it move upward. In some iron foundries making ingot molds, advantage is taken of this principle, and cores with straight or inwardly tapering walls are not tied or wedged down at all. Great care is taken, of course, to see that the space between the core and the print in the mold is sealed so tightly that metal cannot get into it, but no other means are taken to hold the core down.

Tie The Cores Down

Perhaps because they have less confidence in their ability to keep metal from getting under such cores, steel foundrymen seldom if ever follow the example of the makers of ingot molds, but tie their cores down through the drag if they do not reach the upper surface of the casting, and either tie or wedge them down if they extend about to the top of the liquid steel. Cores that do not reach the top of the steel, if made solid, have a hook attached to some of the rods in the core, with its lower end just under the surface of the sand, so that wires may be attached to it, brought down through the drag sand and secured to a bar laid across the bottom of the flask. Sometimes the core is made hollow to facilitate the escape of the gas evolved in pouring, and a notch is filed across its upper end, in which a small rod is set. A similar rod is molded into an extension of the core print in the drag, and a wire is used to tie this rod to the one at the top of the core. The central cavity of the core is then filled with loose dry sand, and the top closed with hard rammed bonded sand, slicked down with the trowel, and dried with a torch.

If such a core is so shaped that it tends to lift, it is better practice to hold it down with a wire that extends through the drag sand, since the rod molded in the drag sand will readily tear out under any but a very slight lifting force. Whatever means is taken to secure cores located in this manner, a hole of ample size must be provided through the drag sand, in order to vent off the gas evolved from the core sand when the mold is filled with steel. Cores extending from top to bottom of a mold, and projecting a little way above the upper surface of the steel, ordinarily are kept in place by wedges driven between plates laid on top of the core and a binder extending across the top of the cope.

(*Continued on page* 137)

The NEW

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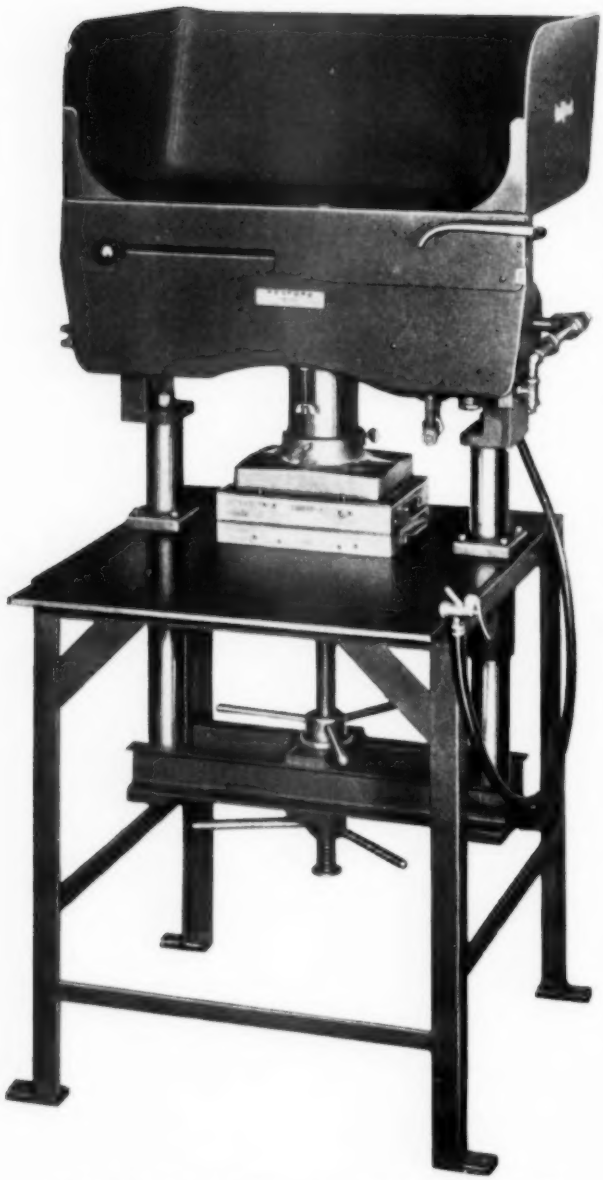

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(*Continued from page* 135)

As explained previously, unless these cores have overhanging portions or are wider at the top than at the bottom, they do not tend to float, provided the space between the core and the print in the mold is sealed so that steel cannot get into it. Tying or wedging them, therefore, is chiefly of use to keep them from being pushed out of position by careless handling of the mold, or by the force of the stream of steel entering the mold from one side through a gate so shaped and located that it sends the metal directly against the core, instead of to one side of it.

Horizontal cores either extending completely across the mold cavity, or reaching part way into it from one wall, are subjected to lifting forces that give rise to stresses which may be figured by the formulas used for beams carrying uniformly distributed loads. We may take, for example, a core 5 in. in diam, and either spanning a mold space 36 in. long, or fixed at one end and extending 36 in. into the mold cavity, with one end unsupported. If a ¾-in. vent and a ¾-in. diam core rod are used, the volume and weight of the core are about as follows:

Volume of core	706.9 cu in
Volume of vent & rod	31.8 cu in
Net sand	675.1 cu in
Weight of sand in core	39 lb
Weight of rod	4.5
Total	43.5 lb

As the core displaces roughly 707 cu in. of steel, it is subjected to a lifting force, evenly distributed over its length, equal to the weight of the equivalent volume of liquid steel, which is 707 times 0.255, or 180 lb. From this must be subtracted the weight of the core, 43.5 lb, leaving a net lifting force of 136.5 lb.

When the core is fixed at two points, 36 in. apart, the bending moment M at its center, is given by the formula: $M = \frac{(W1 + W2)L}{24}$, in which M equals bending moment in in.-lb; $W1$ equals imposed load, or −180 (the minus sign indicating upward pressure); $W2$ equals weight of core, or 43.5 lb.; L equals length of core or 36 in.

Then $M = \frac{(-180 + 43.5)\ 36}{24} = -204.75$ in. lb.

The load, concentrated at the middle of the core, that would produce the same bending moment, may be figured from the formula for concentrated load: $M = \frac{PL}{8} + \frac{W2L}{12}$, in which P = Load concentrated at the middle of core, $W2$ = Weight of core.

Substituting in this equation the value of M for uniformly distributed load obtained above, and solving for P, we have: $-204.75 = \frac{36P}{8} + \frac{(43.5) \times 36}{12}$

Whence P equals −74.5 lb. In other words, this core is subjected to the same stresses by the steel in which it is immersed, that would be produced in it by a lifting force of 74.5 lb concentrated at its middle point.

Were a core a truly elastic body, like a steel beam, the tensile stress in its outside (upper) fibers, would be obtained from the formula: $p = \frac{MX1}{I}$, in which p = Tensile stress in outer fibers; M = Bending moment, in. lb; $X1$ = Distance of outer fiber from center of gravity (½ the diameter or 2.5 in.); I = Moment of inertia of section.

I for a round section is $0.049(\text{diam})^4$, or $0.049(5)^4$, or 30.625.

Then, $p = \frac{204.75 \times 2.5}{30.625} = 16.7$ psi

For a core fixed at one end, and extending 36 in. into liquid steel, the formula is: $M = \frac{(W1 + W2)\ L}{2} = \frac{(-180 + 43.5)\ 36}{2}$ or −2457 in. lb, the minus sign, as before, indicating that the stress is upward.

The equivalent load P, concentrated at the end, that would produce the same bending moment, is obtained from the formula: $M = PL + \frac{W2L}{2}$, whence $-2457 = 36P + \frac{43.5 \times 36}{2}$, and P equals 90.0 lb.

The fiber stress at the outside of the core, by the same formula used above, is: $p = \frac{2457 \times 2.5}{30.625} = 200.5$ psi.

This core, therefore, is subjected to the same bending effect that would be produced by a lifting force of some 90 lb concentrated at its outer end, and were it an elastic body, there would be a fiber stress of about 200 psi set up in its outer portions.

Though these figures for fiber stresses in the cores are no doubt quantitatively inaccurate, they indicate that, as is well known to the foundryman, there is a very strong tendency of the core to "float." Unless properly supported, such a core would undoubtedly break in many instances, and in any event there would be a serious shift of the cored hole.

Again, it is to be kept in mind that these stresses are the same, regardless of the depth to which the core is submerged; so long as it is entirely surrounded by liquid steel, it makes no difference if it is at a depth of an inch or a hundred feet below the surface of the metal. A core in a pipe cast in a horizontal position, for instance, is subjected to stresses that can be calculated by the foregoing methods.

Chaplet Sizes Vary

The size of the chaplets or stem anchors required to hold such cores in position will vary widely with the volume of steel by which the core is surrounded. The ones under the core, to be sure, need retain their strength only until the mold is filled with steel, since from then until the metal solidifies, the core does not bear on them at all, but tries to float and so presses on the chaplets that hold it down. The bottom chaplets, therefore, need only be stiff enough to carry the core in the empty mold, and to resist the tendency of the flowing metal to wash them away.

The upper chaplets, on the other hand, must retain sufficient strength to prevent the core from bending upward, so long as the steel in the mold is fluid enough to permit the core to move, and to exert pressure tending to make it do so. When steel is raised to high temperatures, its strength is enormously decreased, and becomes practically zero at temperatures just below the melting point. Under lifting forces such as are set up in long cores immersed in liquid steel, chaplets so light that they nearly melt away before the metal solidifies will either shorten or buckle, and permit the core to shift seriously. Stem anchors of inadequate size are even more likely to give way by buckling because they are for the most part longer than chaplets.

It follows, therefore, that in order to hold a long core in position in a heavy mass of steel, a chaplet or stem anchor must be thick enough that it will never reach the temperature of the surrounding fluid metal, except perhaps on its extreme outside, just before complete solidification of the metal takes place. Usu-

ally, such chaplets will not fuse to the steel, and so become an integral part of the metal. To secure the maximum strength in such a casting, therefore, it is necessary to burn the chaplets out and weld up the places where they were located.

In very many cases, since considerable welding will be required on the casting if chaplets are used, it is as well to have branch prints on the core that extend through the wall of the casting and are firmly supported on plates molded into the sand of the mold. The holes so formed can often be repaired by welding at less cost than when chaplets have to be burned out before any welding is done, and there is no uncertainty as to whether all the holes have been repaired, whereas there is always the possibility that some chaplets have been missed.

When heavy castings of large size have been poured, the sand in the mold and the flask members absorb a great deal of heat from the casting, consequently their temperature rises considerably and they expand correspondingly. Binders as a rule are in contact with the flask on one side only, and the tie rods may not touch the mold at all, so that their temperature rises much less than that of the flask members. The stresses set up in the rods from the expansion of the sand and flask will in some cases be high enough to strip the nuts off the bolts. It is essential, therefore, to loosen the nuts at intervals for several hours after the molds are poured, so that the stresses in the tie rods will be kept within safe limits. In designing binders for large molds, too, it is well to keep this in mind, and to use sections that at first sight might seem far too large for the purpose. Binders for big molds, of course, should always be made of steel, the strength of cast iron being so low that if that material were selected, the binders would be far too heavy and bulky.

In the coreroom, the principal pieces of equipment required, in addition to the coreboxes, are the plates on which the cores are set for drying. Those of the smaller sizes are generally made of a composition of some sort, such as the asbestos and cement mixture. This material is comparatively light, and does not readily crack or warp under the heat of the ovens. Larger ones are usually of reinforced plate or cast iron, such as are illustrated in Fig. 17. Some steel foundries making very large cores cast their own drying plates out of steel, using a special design consisting of two parallel plates connected at a number of points by small integrally cast cross members. The upper plate is perforated with a number of cored holes, which serve the double purpose of allowing the escape of gases from the inside core when the plates are cast, and of providing passages for the venting off of steam and gas from the cores that are dried on them.

Should the core drying plates warp to any extent in the ovens, the longer cores dried on them will be so crooked or warped as to require extensive filing and rubbing, or even to be unfit for use. In regular steel foundry practice, a considerable amount of rubbing to size is not too serious a matter in cores of moderate length, but a long core that has warped out of true can seldom be used at all. If cement-bonded sand is used, filing or rubbing a core to more than a very slight extent is so slow and expensive as to be out of the question. It is especially important that cores used to build up a mold should be shaped properly so that the joints between them will be tight. Steel foundries using cement bonded sand therefore provide themselves with heavy core plates with carefully machined upper surfaces, and take particular pains to keep them in good condition.

Very large cores, if not so shaped as to be supported on the arbors that serve to reinforce them, are arranged to be hung up by suitable supports welded to extensions of the rods or arbors, and attached to empty flasks of suitable size and shape. Such cores, more properly perhaps termed drawbacks, since they are quite often molded against part of the pattern instead of in core boxes, are extensively used in the production of large heavy steel castings.

Meetings of Interest to Foundrymen

Feb. 2-4—Birmingham Regional Foundry Conference, sponsored by Birmingham AFS chapter, Tutwiler Hotel, Birmingham

Feb. 9-10—Wisconsin Foundry Conference, sponsored by Wisconsin Chapter, AFS, and University of Wisconsin, Schroeder Hotel, Milwaukee

Feb. 20-21—Purdue University, materials handling conference, West Lafayette, Ind.

Feb. 24—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Feb. 27-Mar. 3—American Society for Testing Materials annual committee week, William Penn Hotel, Pittsburgh

Mar. 3—Malleable Founders' Society, eastern sectional meeting, Commodore Hotel, New York

Mar. 10-11—Ohio Regional Foundry Conference, Cincinnati, sponsored by Ohio AFS Chapters and University of Cincinnati.

Mar. 21-22—Steel Founders' Society of America, annual meeting, Edgewater Beach Hotel, Chicago

Mar. 24—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Apr. 4-8—Chicago Technical Societies Council, national production exposition, Stevens Hotel, Chicago

Apr. 28—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

May 8-12—American Foundrymen's Society, annual convention and exhibition, Public Auditorium, Cleveland

May 19—Malleable Founders' Society, eastern sectional meeting, Commodore Hotel, New York

May 26—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

June 1-3—Electric Metal Makers Guild, annual meeting, Shawnee Hotel, Springfield, O.

June 22-23—Malleable Founders' Society, annual meeting, The Homestead, Hot Springs, Va.

June 26-30—American Society for Testing Materials, annual meeting and exhibition, Haddon Hall, Atlantic City, N. J.

July 28—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Oct. 12-14—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.

Oct. 19-20—Gray Iron Founders' Society, annual meeting, Netherland Plaza Hotel, Cincinnati

Oct. 23-27—American Society for Metals, congress and exposition, Chicago

Nov. 9-10 — National Foundry Association, annual meeting, Edgewater Beach Hotel, Chicago

What's the right X-Ray film?

Product:
Cast part for vital aircraft pump
Material:
Aluminum, 2¼" thick, 11¼" diameter
Equipment:
150kv x-ray unit

ANSWER:

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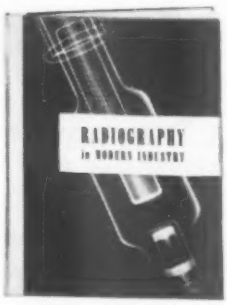
With time, money and safety at stake, radiography was used to check this important casting for defects. With moderate kilovoltage to work with, and with aluminum as the material, the radiographer selected Kodak Industrial X-ray Film, Type A.

For with light alloys, this film has enough speed to keep exposures reasonably short even at low voltages. Its high contrast and fine graininess also permit taking full advantage of high kilovoltage machines in detecting irregularities in thick dense materials.



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To provide the recording medium best suited to any combination of radiographic factors, Kodak produces four types of industrial x-ray film. They also provide the means to check welds efficiently and thus extend the use of the welding process.

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Type M—provides maximum radiographic sensitivity, under direct exposure or with lead-foil screens. It has extra-fine grain and, though speed is less than in Type A, it is adequate for light alloys at average kilovoltage and for much million-volt work.

Type F—provides the highest available speed and contrast when exposed with calcium tungstate intensifying screens. Has wide latitude with either x-rays or gamma rays, exposed directly or with lead screens.

Type K—has medium contrast with high speed. Designed for gamma ray and x-ray work where highest possible speed is needed at available kilovoltage without use of calcium tungstate screens.

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READERS' COMMENT • • •

New Pattern Material

TO THE EDITORS:

We have read with considerable interest the articles by Hiram Brown on precision casting in the November and December issues of THE FOUNDRY. However, we believe that certain comments made by the author with reference to plastic patterns no longer apply in view of a new material recently placed on the market. Developed by our firm under the designation Ard-Lustrex 15 K, this new plastic pattern material can be molded in cast zinc-base alloy dies at a pressure of 1000 psi and a temperature of 350° F.

Material has strength, rigidity and stability, and patterns made from it can be handled without particular care and stored indefinitely without danger of distortion. In drying and firing no mold cracks will result due to controlled expansion properties, and no ash is left after firing.

A.R.D. Corp. E. I. VALYI
New York

* * *

Recommends Silicon Addition

TO THE EDITORS:

A question was asked in the January issue of THE FOUNDRY in the "Questions and Answers" section about the use of more than 25 per cent steel in the cupola charge and what changes in operations should be made. The answer dealt entirely with various means of increasing the carbon content of the molten metal due to the low carbon in the charge. It was suggested that the silicon be kept low in the charge in order to get a maximum pickup of carbon from the coke bed and from the various other materials added for the same purpose.

The reply was very good as far as it went. However, there was an entirely different approach to the problem which was completely ignored.

It must be remembered that carbon and silicon supplement one another. What the iron lacks in carbon can be made up by silicon, giving a fine machinable iron and the highest tensile strength attainable without the use of alloys. Many foundries are using this method regularly with excellent results. With a low carbon content silicon can be used in sufficient quantities to give almost any desired tensile properties. This gives flexibility unattainable when the carbon content is high. Instead of deliberately keeping the silicon content of the charge low, silvery pig iron is used in the base charge with the steel to give a fine uniform blend of the desired composition. The only precaution necessary in melting is to increase the coke in the splits to compensate for the carbon which is normally absorbed during the melting operation. When low-carbon-content iron is produced there is a tendency to eutectiform carbon structure and hence it is customary to use an inoculation with a small amount of ferrosilicon or other inoculant.

WILFRED H. WHITE
Metallurgist
Jackson Iron & Steel Co.
Jackson, O.

* * *

Cupola Report Card

TO THE EDITORS:

In a recent issue of THE FOUNDRY a reader requested a suitable form to be used as a daily cupola report. The accompanying form has been in use for several years and has served its purpose quite satisfactorily where the average daily heat is between 7 and 8 tons. The 5 x 8-inch forms, 100 to the pad, are supplied by a local printer. They are filed daily in a small cabinet provided for the purpose. The form also serves as a cleaning room report. This item is filled in by the cleaning room foreman, the day following the heat. The serial heat number and date are carried in the upper left corner. The first two digits refer to the year, in this instance 49. The other three digits indicate the serial heat number. That is, this report covers heat 67 in the year 1949.

HERBERT FARR

* * *

Melting Steel in Cupola

TO THE EDITORS:

On page 97, October, issue of THE FOUNDRY, we note that somebody has asked "Can gray iron castings be made with steel scrap in the cupola."

It may be of interest to your readers to learn that we made ¼-in. section gray iron castings from 100 per cent steel scrap charge in the cupola. These castings were pump impellers and they machined perfectly. We figured the silicon content of the metal out of the cupola was 0.10 per cent. Silicon specification in the castings called for 2.50 per cent. This specification was met by adding 2.40 per cent silicon in the ladle via Sil-X.

GORDON B. THOMSON
Exothermic Alloys Sales & Service Inc.
Chicago 27, Ill.

* * *

How To Prevent Porosity

TO THE EDITORS:

I have worked in many aluminum and magnesium foundries in Los Angeles and operated my own shop for two years there. At present I am working here as a foundry technician. I have made many castings which had to be porosity free.

Standing in the furnace does not

(*Concluded on page* 144)

FOUNDRY MELTING LOG

HEAT NO. 49067 DATE APRIL 5, 1949

CHARGE	COKE	PIG IRON (BUFFALO 19021 / FOUNDRY 33460 / OTHER 26940)			STEEL	SCRAP PURCH'D	SCRAP SHOP	OYSTER SHELLS	TOTAL METAL ACCOUNTED FOR	
BED	1000	350	175	175	70	315	315	14	FOUNDRY PIG	315
									FOUNDRY SHOT	395
2 TO 9"	1200	2800	1400	1400	560	2520	2520	112	GATES	1068
									RUMBLER SHOT	2999
10	150	400	200	200	80	360	360	14	DEFECT CASTING	262
									GOOD CASTING	8451
TOTALS	2350	3550	1775	1775	710	3195	3195	140	TOTAL	13490

TOTAL METAL MELDED 14,200 POUNDS TOTAL METAL LOST 710 LBS. % 5
CUPOLA LIGHTED 1:05 P.M. FIRST IRON CHARGED 1:15 P.M. BLAST 2:30 P.M.
FIRST IRON 2:55 P.M. BOTTOM DROPPED 3:55 P.M. DURATION 1.42 HOURS
RATE OF MELT 10,000 POUNDS PER HOUR COKE RATIO 1 TO 6
REMARKS MATERIALS USED

20 - SPLIT BRICK
35 # GULIC SAND

ANALYSIS

	Si	Mn	P	S
CALCULATED	2.00	.60	.40	.08
CHEMIST'S	2.08	.65	.389	.09

WHY FOUNDRYMEN PREFER

Puts the squeeze

Hose Connections

Vibrators

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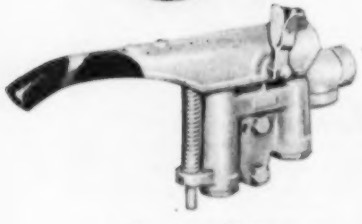
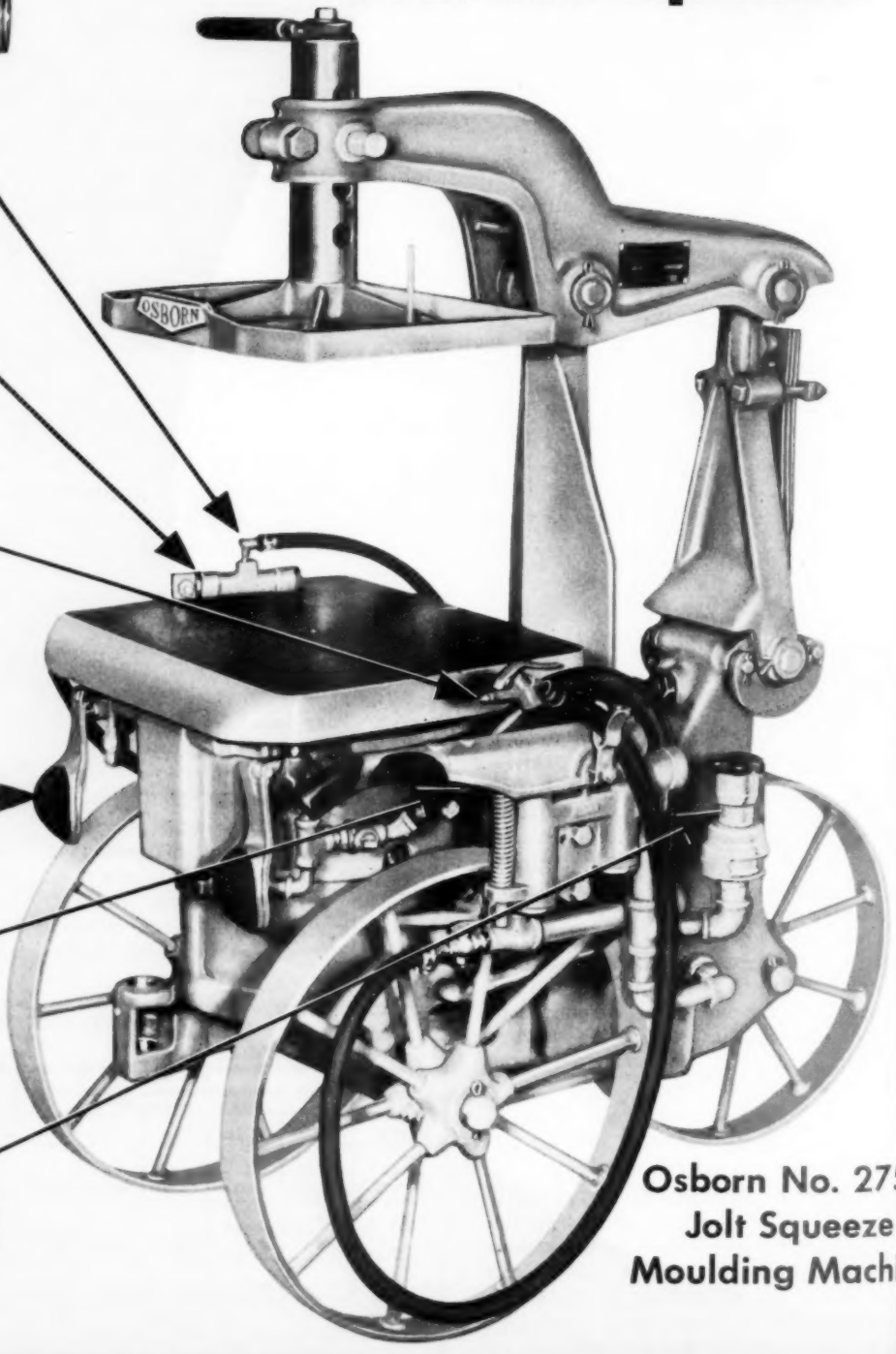


Squeeze Valves

Automatic
Squeeze Pressure
Release Valves



Osborn No. 275
Jolt Squeeze
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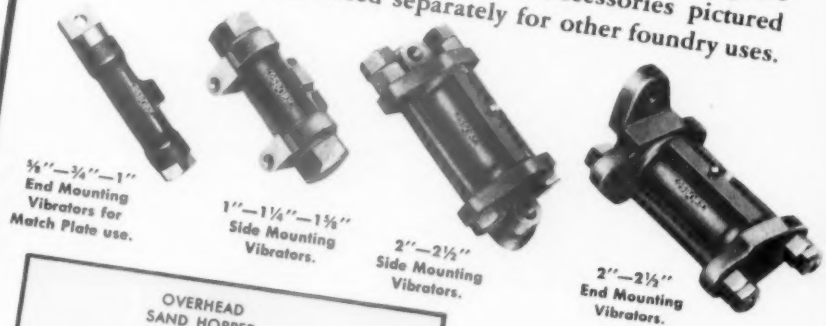
OSBORN JOLT SQUEEZERS are built in both portable and stationary types and in a wide variety of sizes and models. An Osborn factory-trained Field Engineer will gladly analyze your requirements.

A TOP VALUE IN VIBRATORS

Osborn vibrators offer greater power in proportion to size; lighter weight at no sacrifice of strength; economy in air consumption; increased resistance to wear; maximum durability and freedom from sticking. This complete line of vibrators as well as other accessories pictured here may be purchased separately for other foundry uses.

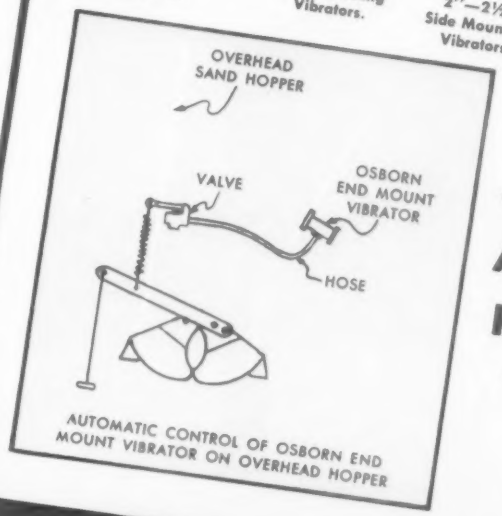


⅜"—¾"—1" End Mounting Vibrators for Match Plate use.

1"—1¼"—1⅜" Side Mounting Vibrators.

2"—2½" Side Mounting Vibrators.

2"—2½" End Mounting Vibrators.



AUTOMATIC CONTROL OF OSBORN END MOUNT VIBRATOR ON OVERHEAD HOPPER

HERE'S ANOTHER USE FOR OSBORN VIBRATORS

OSBORN

MOULDING MACHINES — CORE BLOWING MACHINES

MEMBER MANUFACTURER'S ASSOCIATION INC. FOUNDRY EQUIPMENT

(*Continued from page* 141)

injure molten aluminum, provided it is degassed before it is poured into the molds. Molten aluminum absorbs gas from the air and it should be degassed before it enters the molds. It is not necessary to melt the metal in graphite crucibles. Cast iron pots are preferred.

Metal must be poured hot enough to permit gas to escape through the risers before solidification takes place. Under certain conditions metal must be poured at temperatures as high as 1450° F. In this case, if the metal is Alcoa 356 alloy it will be necessary to add magnesium. Dow's H alloy of magnesium will hold chemical content to proper analysis.

I favor the use of chlorine gas for degassing. It is not expensive nor hard to use, but must be handled with care. Molding sand must show high permeability, and moisture content up to 3.5 per cent. Metal should be poured into the mold as fast as possible. Cast iron chills should be incorporated in the mold in the vicinity of machined areas to promote fast setting of the metal.

If you are interested or have some one in mind who is having gas or porosity problems, feel free to write.

ERNEST M. HUNT
2165 A 45th
Los Alamos, N. Mex.

* * *

Sees FEF Investment Returned

TO THE EDITORS:

This is merely to record my hearty endorsement of your editorial in the October issue of THE FOUNDRY in support of the Foundry Educational Foundation. I sincerely hope that the foundry industry will be willing to continue this venture indefinitely, and I am convinced that the cost of doing it will be recovered a thousand times over in the years to come. Unfortunately, not all foundries contribute but all will profit and there you have the inevitable parasite group who can't be eliminated from any organization or industry. Possibly contribution will become more general as the foundation gains ground.

C. J. FREUND
Dean
College of Engineering
University of Detroit
Detroit

* * *

Liked British Foundry Article

TO THE EDITORS:

I think Vincent Delport did a splendid job in the October issue of THE FOUNDRY on the controls stressed by the British steel foundry industry and I wish to send my sincere congratulations upon it.

W. H. WORRILOW
President
Lebanon Steel Foundry
Lebanon, Pa.

* * *

Cupola Article Helpful

TO THE EDITORS:

I have just finished reading the article "Standards Must Be Observed in Cupola Operations" in the November issue of THE FOUNDRY. This article was most helpful to us.

GEORGE F. LAMBERT
Western Foundry
128 N. Richland St.
Indianapolis

* * *

Praises Editorial on FEF

TO THE EDITORS:

Your October editorial, "Continued FEF Support Is a Sound Investment," in THE FOUNDRY is excellent.

PETER E. RENTSCHLER
President
Hamilton Foundry & Machine Co.
Hamilton, O.

SAFE PLACE TO WORK: Decatur Casting Co., Decatur, Ill., featured the safety display shown above at the annual Decatur Street Fair held Oct. 10-15. Other items in the display included photographs of the plant interior and of the open house held by the company a few years ago. The company has received safety awards from the National Safety Council and the Michigan Mutual Liability Co. each year since 1943, and in the year 1946-47 it was awarded first prize in the Michigan Mutual Liability Co.'s annual safety contest

Issue Book

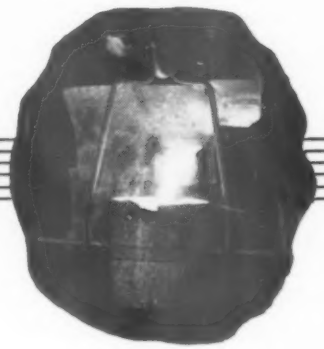
Howard Foundry Co., 1700 North Kostner Ave., Chicago 39, has published a book describing operations of its plant in producing aluminum, magnesium, bronze, gray iron, electric alloy steel and permanent mold castings. A section of the book is devoted to a discussion of magnesium-zirconium-rare earth alloys. Machine shop, patternmaking, and quality control activities also are described.

only REPUBLIC offers you

CHATEAUGAY PIG IRON

the must ingredient for

NODULAR IRON CASTINGS



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Casting Alloys for

PERMANENT MAGNETS

By THOMAS A. DICKINSON

COMPARED with other metal-casting techniques, the casting of alloys for permanent magnets is distinguished by the fact that the finished castings often should have a strained crystal lattice or coarse granular structure—a characteristic normally considered undesirable.

This feature permits a cast material to retain a strong magnetic field for a long period of time; and, while actual particle sizes are usually varied in magnets for different applications, it definitely limits the number of casting designs that are practical for ferromagnetic alloys. For example:

1. Adjacent thick and thin sections must usually be avoided to prevent cracks which will minimize a magnet's usefulness.

2. Close dimensional tolerances should normally be regarded as economically impractical, since the coarse-grained castings must often be finished by grinding.

3. The magnet must be dimensioned and proportioned so that it can be readily magnetized in a strong electromagnetic field, usually produced by a solenoid.

4. Shape of the magnet must be such that it will produce or help produce a magnetic field of specified intensity in a given air gap when it is magnetized and in use.

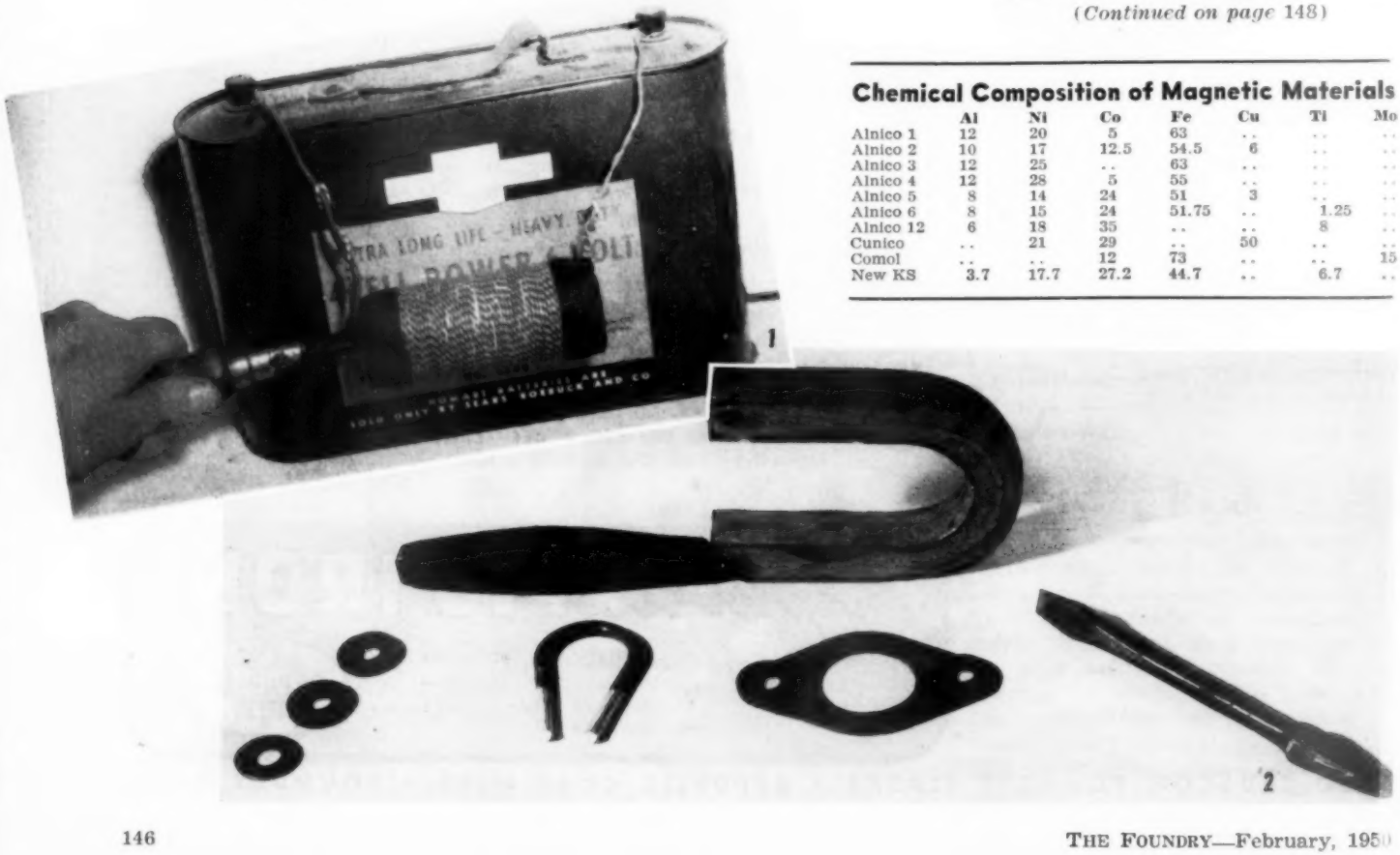
Extent of these design limitations is often proportional to the variety of alloys that can be used for casting purposes; in this connection, it is worth noting that the best materials are not invariably those metals which will retain the strongest magnetic charge. The accompanying table denotes compositions of the alloys which are now most commonly used to make cast permanent magnets. Among these alloys, Alnico (a name coined from aluminum-nickel-cobalt) materials are newest, most numerous, and comparatively versatile. Quenched carbon steels have become almost obsolete as magnet-casting alloys since the early 1900's; and chromium, tungsten, and cobalt steels are currently preferred where special nonmagnetic physical properties are mandatory, since the Alnicos do not have high mechanical strength.

Virtually all magnet-casting work is accomplished with sand molds. However, very small magnets have been accurately produced by investment casting and it is entirely possible that lower unit costs can eventually be realized through the production of standardized magnet shapes with die-casting equipment—thanks to the current developments of better temperature-resistant injection cylinders and molds, plus the recent discovery that certain alloys in the low-temperaure range are ferromagnetic.

A considerable number of foundries use green sand molds in casting ferromagnetic metals, due to the aforementioned need for coarse grain. However, a number of specialized producers, such as the Arnold Engineering Co., Chicago, prefer dry sand molds where it is necessary to maintain nominal dimensions without excessive grinding. The latter company, which makes almost exclusive use of Alnico alloys, indicates

(*Continued on page* 148)

Fig. 1—Magnetizing a small bar magnet by insertion in a solenoid. Fig. 2—Typical permanent magnets



Chemical Composition of Magnetic Materials

	Al	Ni	Co	Fe	Cu	Ti	Mo
Alnico 1	12	20	5	63	..	..	..
Alnico 2	10	17	12.5	54.5	6	..	..
Alnico 3	12	25	..	63	..	..	..
Alnico 4	12	28	5	55	..	..	..
Alnico 5	8	14	24	51	3	..	..
Alnico 6	8	15	24	51.75	..	1.25	..
Alnico 12	6	18	35	..	..	8	..
Cunico	..	21	29	..	50	..	..
Comol	..	..	12	73	..	..	15
New KS	3.7	17.7	27.2	44.7	..	6.7	..

Make Parting Easier
Cut Rejects
Reduce Foundry Smoke

USE **"dag"** dispersions in your foundry because they:

IMPROVE PARTING by preventing adhesion of cast objects to mold cavities and cores.

CUT REJECTS and finishing costs because castings are reproduced in the finest detail. Films formed by **"dag"** dispersions are smooth . . . resistant to heat . . . extremely durable, and will not measurably affect mold tolerances.

REDUCE SMOKE and give men in the shop a break, because aqueous **"dag"** dispersions do not give off clouds of smoke and choking fumes.

Spray or brush it on chills, dies, patterns, ladle interiors and permanent molds. Eliminate binding and stripping, too, by using **"dag"** colloidal graphite to lubricate push pins, shoulder screws, flask pins, or any screw threads.

Acheson Colloids is equipped to do custom disintegrating, dispersing, and stabilizing of solids in a wide variety of vehicles. If you are in need of this type of service, tell us about it. We may be able to help you.

ACHESON COLLOIDS CORPORATION
Port Huron, Michigan

☐ Send me the NEW Foundry Bulletin #425

☐ Send an Acheson engineer

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CITY.....ZONE.....

STATE.....

F14

dag DISPERSIONS

Acheson Colloids Corporation, Port Huron, Michigan

. . . also Acheson Colloids Limited, London, England

(*Continued from page* 146)

that its use of dry sand molds ordinarily permits the following "as cast" tolerances: ±1/64-in. on dimensions up to 2 in.; ±1/32-in. on 2 to 4 in., and ±3/64-in. on 4 to 6 in. For dimensions of more than 6 in. these tolerances are reportedly increased by 1/64 in. for each 2 in. dimensional increase.

The Arnold dry sand casting process has been officially described as follows:

"Holes for fastening purposes are cored in the magnet with sand or graphite rods. Whether sand or graphite cores are used depends on the size, length, tolerance, and smoothness required for a given hole. Graphite rods are somewhat stronger than sand rods and will resist the erosive action of the cast metal; hence, they are used where holes must be very small, very long, or very smooth. Sand cores produce a comparatively rough finish, but will usually maintain tolerances of about ±.015-in. per in. diameter (i.e., where the ±.005-in. per in. tolerances of commercial graphite cores are nonrequisite). Hole tolerances of less than ±.005-in. per in. diameter have been maintained, when necessary, with precision-ground graphite and precision-molded sand cores.

"Tolerances governing the distance between two or more holes in a casting are ±1/64-in. from 0 to 1 in., ±1/32-in. from 1 to 3 in., and ±3/64-in. from 3 to 5 in. When three or more holes are required, the deviation from nominal dimension to a plane or center line may be in the neighborhood of ±1/32-in. The dimension of a hole or other cored opening that can satisfactorily be made in a casting is a function of wall thickness for the finished casting. Loud speaker rings of 3 and 4-in. diameters and approximately 2 in. high have been cast without cracking with minimum wall thicknesses of approximately 5/16 to 3/8-in. Smaller rings of the same or less height can be cast with a minimum wall thickness of 3/16-in., while longer rings or cylinders require heavier walls to prevent cracks or warpage.

"Rectangular bars up to 8-in. length have been satisfactorily produced with a 1/8-in. thickness, where the other dimension was not less than 1/4-in. Round bars with a diameter of 1/8-in. should, in general, be no longer than 4-in. because such bars are subject to warpage—both in the casting process and during subsequent heat treatments. Small round bars up to 3/8-in. diameter and rectangular bars of a comparable size and uniform cross section can be precision cast for relative straightness and smoothness at tolerances of ±.005-in. without eventual grinding.

"Flat plates with thicknesses of about 1/8-in. are cast for a maximum area of 1 sq in. which plates of greater thicknesses may have proportionally larger areas without acquiring hairline cracks (particularly around cored holes) . . . Where variations in the cross-sectional dimensions of a casting are required, large radius fillets may prevent eventual cracks. Sharp corners have been cast with reasonable accuracy with Alnico alloys, but as a rule it has been found desirable to round all corners (if possible) to prevent chipping.

Avoid Section Changes

"Notches and grooves, together with lugs and ears, fall in the same category as abrupt changes of section. The bottom of a notch or groove should be rounded to prevent high stress concentrations, and lugs or ears should be dimensioned to minimize the possibility that they will be chipped or broken off. Slots which are to be used to accommodate fastening screws, as in meter magnets, are best cast if a 1-degree draft is allowed on the sides of each slot and should be no narrower than 1/8-in. unless it is desirable to clean the slots during a final grinding operation.

"One of the frequently attempted methods of fastening Alnico magnets to adjacent structures has been to use cast-in iron or stainless steel inserts, which may later be ground flush with the castings and drilled or tapped to receive screws or related assembly components. This is not a recommended practice whenever it is possible to use any other method of assembly because metallurgical examinations will usually reveal many hairline cracks around the inserts due to abnormal shrinkage. These cracks will be enlarged by following heat treatments, and may cause an ultimate failure if a magnet is exposed to vibrations or slightly-excessive loads . . . Where inserts are specified, wall thicknesses around the inserts should be at least equal to and preferably twice the diameter of each insert; and, even

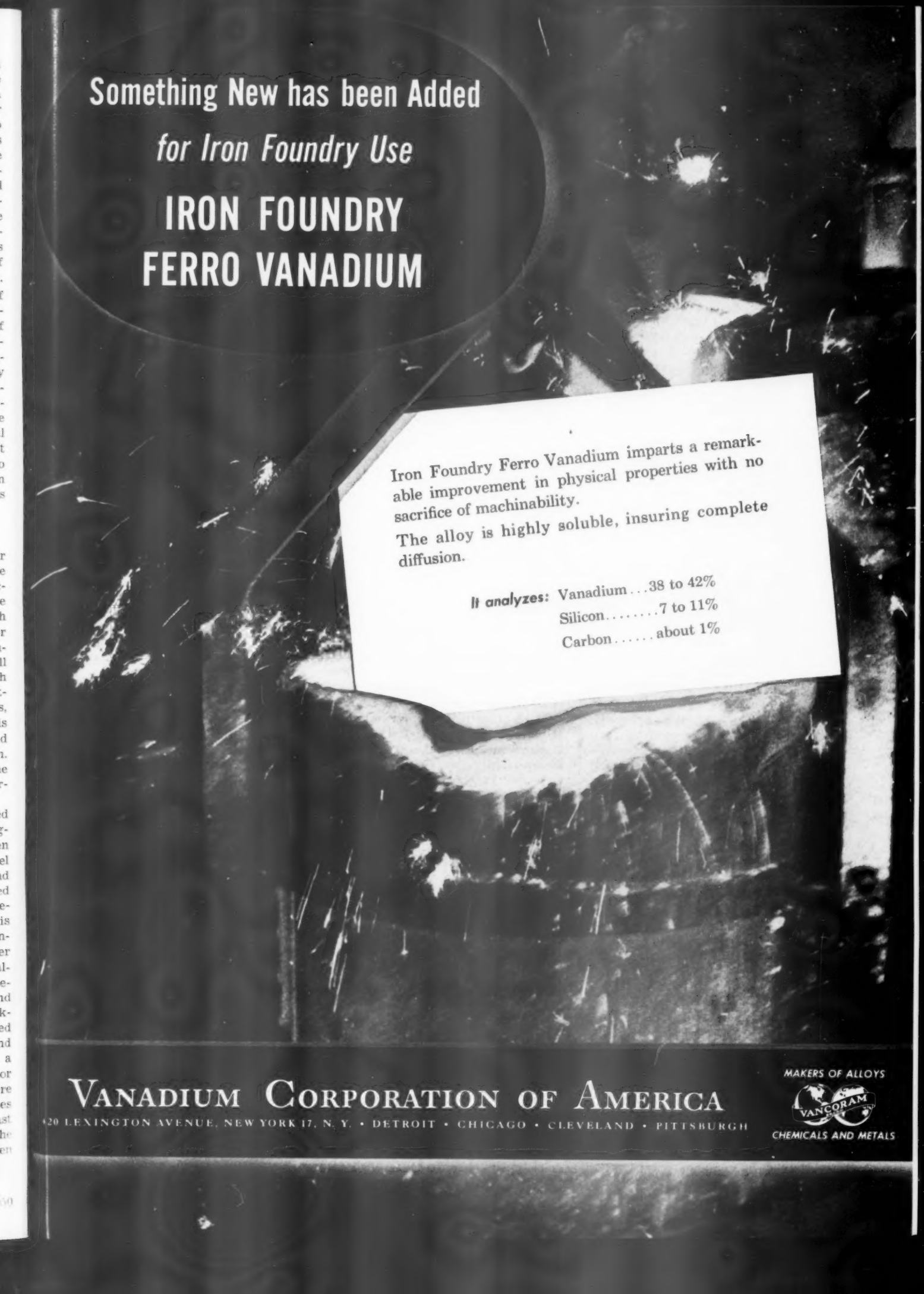
(*Concluded on page* 150)

Attachment Converts Crane Truck to Shovel

THROUGH use of a simply constructed special attachment a crane truck can be adapted to use for shoveling snow, sand, gravel, coke and other bulk materials. The attachment comprises a large welded steel scoop and a rig for mounting it to the truck.

The rigging is a structural steel "A" shaped element, two lengths of chain and a piece of iron pipe. The "A" shaped element is pinned, at the narrow end, to the base of the boom on the truck. The scoop is pinned between the legs of the "A." The chain, with the pipe used as a spreader, supports the "A" structure and the scoop from the top of the boom.

In operation, the bin is lowered to the ground to scoop up the material. When filled, it is lifted for transport by raising the boom, and is dumped by lifting the crane hook, which is engaged with an eye welded to the back of the bin. Photo courtesy the Yale & Towne Mfg. Co., Philadelphia.


Something New has been Added
for Iron Foundry Use
IRON FOUNDRY
FERRO VANADIUM
Iron Foundry Ferro Vanadium imparts a remarkable improvement in physical properties with no sacrifice of machinability.
The alloy is highly soluble, insuring complete diffusion.
It analyzes: Vanadium...38 to 42%
Silicon.....7 to 11%
Carbon.....about 1%
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MAKERS OF ALLOYS
VANCORAM
CHEMICALS AND METALS

(*Concluded from page* 148)

then, cracks must be anticipated."

Cast Alnico magnets are normalized at temperatures of about 2000° to 2400° F, and quenched for optimum hardness. Alloys 3 and 4 require fast-quench operations as a rule, because they cannot be further heat treated if their respective thicknesses are greater than 1½ or ¾-in., while the remaining Alnicos are usually quenched slowly. Alnico 5, which will retain optimum magnetic properties for permanent magnets that are commerically available at this writing, is usually stressed during the cooling interval with a magnetic field created by multi-pole rotors in a direction parallel to the axes that will be magnetized in the finished casting. Special stressing fixtures are used in connection with horseshoes and other shapes with "bent" axes; but not with bars, rings, or shapes with straight-line magnetic axes.

Final heat treatments for Alnico alloys, where practical, can be generally described as drawing operations at temperatures of about 1000° F. Thereafter, castings can be finished to tolerances of as little as ±.0005-in. by grinding. Closer tolerances have been maintained by lapping or honing, but only at increased production costs.

In several western foundries, where magnetic alloys are cast in green sand molds, metal-spray equipment is used to repair small pits or blowholes in magnet castings. This is followed by grinding with aluminum-oxide or similar abrasives, which have a relatively soft bond.

Generally speaking, it is more difficult to grind Alnico castings than equivalent areas of tool steel because the material is exceedingly hard and brittle. However, both internal and external grinding can be accomplished with normal production methods and standard equipment if adequate quantities of coolant are used to prevent heat-checking and if grinding pressures are light enough to prevent chipping.

Cast magnetic alloys are usually saturated in electromagnetic field of 4000 to 20,000 gauss, depending on the coercive force required to permeate a specific material. This requires the use of solenoids or magnetizing coils with 4000 to 6000 ampere turns per linear inch and the current provided by step-down transformers or storage batteries.

After saturation, a magnetic casting will slowly lose a certain percentage of its charge for a period of about 12 to 24 hours before it will become "stabilized"— that is, unless it is artificially aged by demagnetization and recharging in the original magnetic field. Demagnetization is usually accomplished by placing the magnet in a low-frequency alternating current field, which requires the use of a coil the same as in magnetization.

Service Awards

Four employees of American Steel Foundries, East St. Louis, Ill., have become members of the company's veterans club for completion of 25 years' service with the firm. Presentation of jeweled watches was made to the new members by L. C. Farquhar, works manager, at the sixth annual dinner meeting of the club Dec. 13. The new members are Mrs. H. M. Gilligan, K. F. Griffin, J. L. Hopkins and R. C. Smith. The club membership includes 41 active members and 12 honorary members.

EXHIBIT: Great Lakes Mfg. & Foundry Co., Wyandotte, Mich., showed this exhibit at the recent Michigan Downriver Industrial Empire Exhibit, Trenton, Mich. The company pours castings ranging in size from 4 oz to 6000 lb

British Founders See Higher Production

British steel founders believe they can increase their productivity 10 to 25 per cent in the near future. This was indicated at a productivity conference of the British Steel Founders' Association, Nov. 17 to 19, attended by 125 men selected from almost all ranks of member companies' personnel.

Six papers presented and discussed at this meeting covered the information gathered by the steel founding team which visited the United States early last year. At the conclusion of the meeting, F. A. Martin, chairman of the BSFA and leader of the Productivity Team, stated that the convention had accepted as a basic principle that higher productivity is an essential if the industry and the employment it provides are to survive.

Three means recommended to increase interchange of information on the subject are: A productivity group to tour British steel foundries; a second conference to report progress; regional productivity councils within the BSFA.

The convention also recommended that steps be taken to secure adequate supplies of acid melting scrap for steel foundries, to enable the acid melting method to be adopted more widely. Another recommendation was that recognition be sought of the industry's priority power requirements, so as to correct the inefficiencies caused by measures imposed to conserve electric power supply throughout industrial Britain.

Book Review

Transactions of the American Foundrymen's Society, Vol. 57, 1949, cloth, 637 pages 8⅛ x 11⅜ in., published by the American Foundrymen's Society, 222 West Adams St., Chicago 6.

Summarizing proceedings of the society's 53rd annual convention held in St. Louis May 2-5, this volume contains transcripts of all technical papers and discussions presented during the convention. Data on metallurgical, engineering and control aspects of casting practice are covered in the 61 articles included. Subject and author indices make the information readily available for reference. The appendix includes not only minutes of the convention business meetings, but also reports on board of directors meetings held during the year and the 1949 chapter chairmen's conference.

NEW IDEAS

For Faster Production - - and Lower Costs

Take For Example —

the 8 gang dump box shown in the unretouched photograph above, measuring 13½ x 9½ x 2½ and weighing only 12 pounds, was made from the single wood master core plug and backing frame. The price, believe it or not, about $36.00.

Also made by the same method are two part split or booked core boxes with flat or irregular partings together with properly cleared white metal master dryer patterns.

There is profit in this idea for you. Hundreds of foundries are now using this modern streamlined method of making core boxes and master dryers because it is accurate, saves machining and offers large savings in the intricate and gang type core box.

Your inquiry will receive prompt attention.

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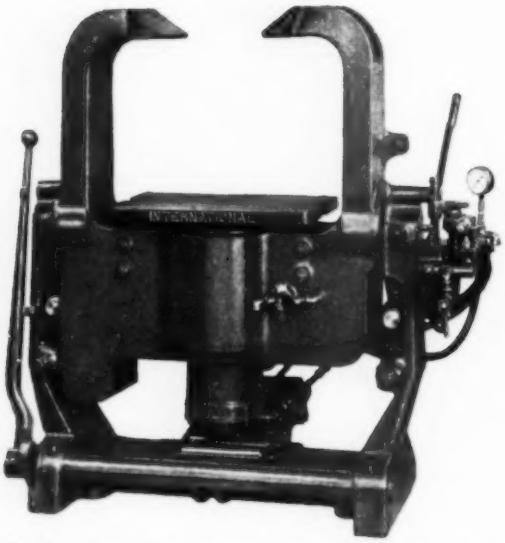
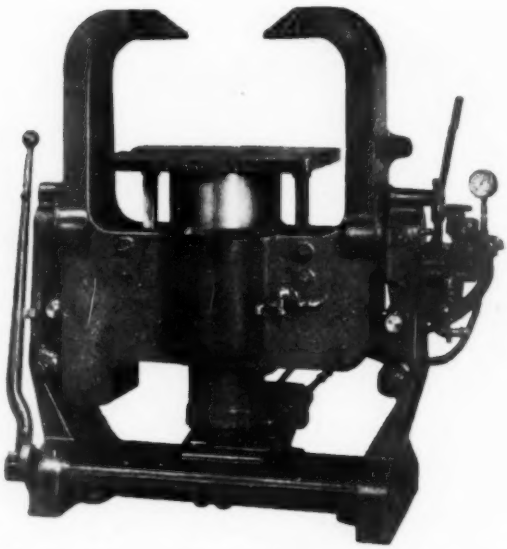
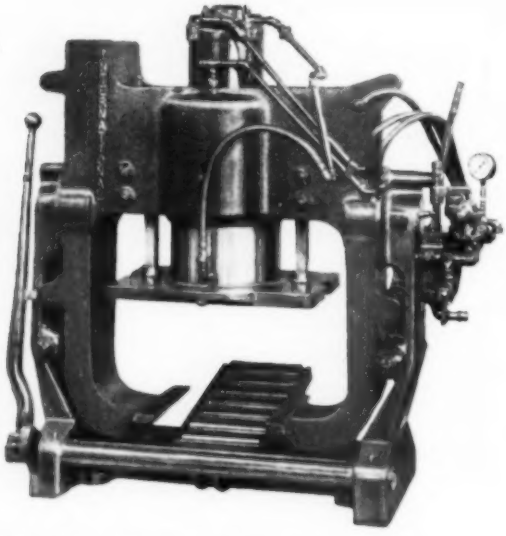
OPERATING CYCLE OF THE RES MACHINE



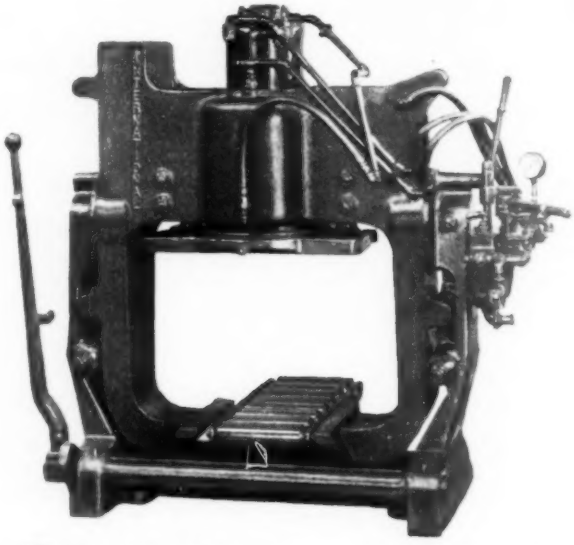
1 JOLTING POSITION . . . ready for flask, sand and jolting. Strike-off and place bottom board on sand.



2 SQUEEZE POSITION . . . actuation of squeeze valve raises squeeze piston, thereby squeezing the mold and clamping the bottom board and flask into one integral unit, ready for rollover.

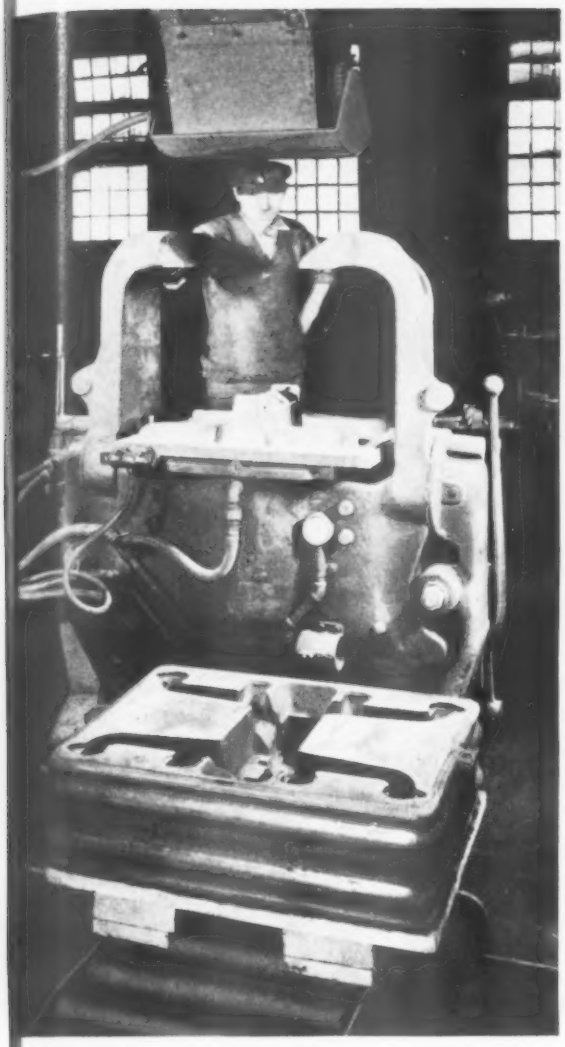


3 ROLLOVER POSITION . . . a slight pull of rollover frame by hand, rolls the machine over ready to operate the draw.



4 DRAW POSITION . . . by actuation of the vibrator valve and draw valve, the pattern is drawn from the mold. Rollers are then raised and mold pushed out by foot.

INTERNATIONAL



Features of the Type RES Machine

The fastest type Jolt, Squeeze, Rollover, Draw Machine.

Draw is always true because of integral frame and draw feature.

Completely above floor line . . . no pit necessary.

Engineered for ease of maintenance.

The **Type RES** is designed, as are all machines in the INTERNATIONAL LINE, by experienced foundry engineers who have a practical working knowledge of the problems of the business.

Inquiries should specify maximum outside width and length of the largest flask to be used, including trunnions and handles, allowance required for depth of flask, pattern plate and bottom board and amount of draw required.

MOLDING MACHINE COMPANY

LA GRANGE PARK, ILLINOIS

Man-to-Man

ON THE MOLDER'S BENCH

"The Idea Blitzers"

By RALPH L. LEE

IF I EVER had an inclination to get cocky (Heaven forbid) I sure would have had it all knocked out of me on this last foundry trip up and down the West coast. The most outstanding impression I came back with was that God certainly did not pile all the brains He had to shell out onto any one spot; He seems to have sifted them out quite evenly all over the map.

Of the some twenty or more foundries I visited, there was not even one in which I did not find several things worth writing home about. As an amateur, I of course realize that just because something is new or interesting to me doesn't make it important to a dyed-in-the-wool foundryman. But even allowing for this, I don't see how even the most experienced could have gone along with me on this trip without having to agree that most of our foundry folks are up on their toes, with their eyes wide open and using their heads for something besides hat-racks.

Now that I think about it, I feel quite sure that most of the interesting and ingenious things I saw came about through the efforts of folks who might well be grouped together and tagged with the old pun, "The darned fool didn't know it couldn't be done, so he went ahead and did it."

This observation, together with a magazine article I read on my way back home, gave me the idea of writing this little article. I've looked high and low for that magazine, so I could give credit where credit is due, but I haven't been able to find it. Anyway, this article proved beyond all question of doubt the great advantage of putting a gag at times on those killjoys and negative kibitzers who are always standing by with their hands and minds behind their backs, ready to blast any new idea full of holes the minute some well meaning person suggests one.

To put the clamps on such dudes the fellow who wrote the article had invented a new type of idea-getting meeting. The understanding was for everybody present to come up with at least one idea, no matter what it was. And then to protect them, anybody who so much as dared to open his trap to criticize or condemn, that idea blitzer was to be banished into the outer darkness of disgrace.

Once the fear of making a fool of themselves was completely washed out, things started to hum and ideas began piling up at a lively rate, with good ones coming from the least suspected places. While the article went on to say that some of the ideas weren't so hot, there were enough prize winners mixed in with the good and fair-to-middlin' that the meeting plan was one whale of a success.

While it is sad, it is certainly true, that there are some individuals with little or no imagination, who can find no other way of distinguishing themselves than by criticizing others who do have. Such folks don't seem to be satisfied with just pointing out what they think is wrong with a suggestion; they go clear out of their way trying to make a fool out of the guy who made it.

Of course, there is a time and a place for everything, even for these fellows. Sooner or later every new idea must run the gauntlet of criticism, and the tougher the running the better it is for everybody, including the author. However, the magazine article points out that the gauntlet-running time has got to be separated from the idea-getting time. After all, the breeding or conceiving of an idea can't be done very comfortably right in the middle of the delivery room.

One foundryman, in telling me of the very best foreman he ever had, said that whenever the gang got together, the old man would find some excuse for saying, "If you guys would spend just one-quarter of the time you now spend figuring out what's wrong with what we've got to do, on figuring out how we're going to do it, we'd all get along twice as fast."

Maybe we ought to put a heavy tax, plus a heavy fine on OUT OF SEASON IDEA BLITZING and then offer juicy prices for FEARLESS IDEA PROPAGATING. Then as a P. S. it might be a good idea to make it a rule that everybody in the place is required to cook up at least one new idea each day, each week or what have you.

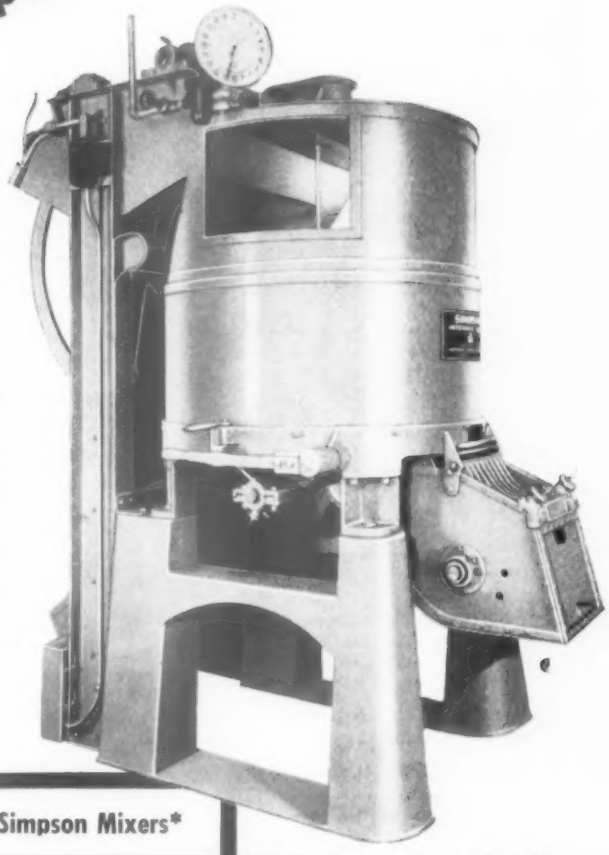
I'll bet that some of the screwiest looking ideas would turn out doggone good. Anyway, it's an idea.

GREATER CAPACITY

in TONS

per batch...
per hour...
per day...

When it comes to turning out more tons of properly conditioned and cooled sand, with resulting high mold capacity per working day, you just can't beat the high efficiency of SIMPSON MIXERS. Yet with this high productive capacity, you actually require fewer mixing cycles per hour, because of the large batch capacity of the mixers. Thus, with greater capacity and fewer mixing cycles, you have ample time to take frequent sand samples, to accurately determine and improve sand quality for a net result of more good castings at lower cost.



ABOVE: Typical No. 2 SIMPSON MIXER unit, with NATIONAL Bucket Loader, Aerator and Water Meter. LEFT: No. 3 SIMPSON MIXER preparing backing and facing sands in foundry of a large machine tool manufacturer.

** Rated batch capacities of SIMPSON MIXERS are not theoretical figures . . . they are proved on the job in hundreds of large and small foundries all over the world. Ask to have a National Engineer show you how to increase production, improve quality and lower cost.*

Batch Capacities of Simpson Mixers*	
No. 3½ Mixer	5000 lbs.
No. 3 Mixer	3000 lbs.
No. 2 Mixer	1500 lbs.
No. 1½ Mixer	700 lbs.
No. 1H Mixer	400 lbs.

*Based on actual practice in hundreds of foundries.

SIMPSON Intensive MIXERS

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FOUNDRY Statistics

Ingot Brass and Bronze

(Shipments in net tons)

	1949	1948
Apr.	10,695	25,177
May	11,114	23,716
June	9,696	24,401
July	10,220	20,456
Aug.	14,194	24,098
Sept.	16,208	23,641
Oct.	18,036	21,559
Nov.	18,488	21,731

Source: Ingot Brass and Bronze Industry.

Foundry Production Workers

ESTIMATED NUMBER:

Type Foundry	Sept. 1949	Aug. 1949	Sept. 1948
Iron & steel	174,000	177,400	233,100
Nonferrous	62,000	59,600	73,300

AVERAGE WEEKLY EARNINGS:

Gray Iron	$55.18	$53.14	$58.85
Malleable Iron	54.11	53.46	60.72
Steel	53.81	54.50	61.01
Nonferrous	61.66	59.94	60.30

AVERAGE WEEKLY HOURS:

Gray Iron	37.9	36.7	40.7
Malleable Iron	35.0	35.1	40.0
Steel	35.4	35.9	39.8
Nonferrous	39.4	38.5	38.9

LABOR TURNOVER RATE (SEPT.)

(Per 100 employees)

	Total Accession	Total Separation	Quit	Layoff
Gray Iron	4.1	4.4	1.6	2.5
Malleable Iron	3.3	3.8	1.0	2.4
Steel	2.4	5.3	0.8	4.3

Source: Bureau of Labor Statistics.

Index of Foundry Equipment Orders

Foundry Trades Only

(Net Orders Closed, New Equipment)

	1948	1949
Jan.	380.9	149.9
Feb.	367.3	144.4
Mar.	326.2	190.8
Apr.	412.0	172.0
May	388.5	121.9
June	376.8	164.9
July	456.3	146.6
Aug.	324.7	127.1
Sept.	273.5	166.6
Oct.	296.0	133.5
Nov.	284.4	270.4
Dec.	243.7	....

Note; Figures are percentages of the base period 1937-1939 taken as 100 per cent (monthly average). Source: Foundry Equipment Manufacturers Association.

Shipments of Castings

(Reported by Bureau of the Census)

Gray Iron

(Net tons)

	Shipments Total	Shipments For Sale	Unfilled *Orders
1947			
Total	12,540,960	7,181,299	.....
1948			
Aug.	1,050,948	597,678	2,598,789
Sept.	1,088,051	615,978	2,587,385
Oct.	1,148,422	642,485	2,522,831
10 mos. total	10,575,570	5,900,286	.....
Nov.	1,099,827	606,380	2,406,737
Dec.	1,110,512	624,739	2,284,348
Total	12,785,909	7,131,405	.....
1949			
Jan.	1,040,343	573,164	2,064,861
Feb.	986,591	535,163	1,857,403
Mar.	1,074,704	567,041	1,639,465
Apr.	929,307	467,433	1,445,532
May	866,631	439,420	1,243,266
June	905,573	455,442	1,086,989
July	696,915	341,657	1,031,963
Aug.	872,013	445,981	1,048,308
Sept.	880,647	459,014	980,070
Oct.	715,635	397,939	955,100
10 mos. total	8,968,409	4,682,254	.....

Aluminum

(Thousands of pounds)

	Shipments Total	Sand	Perm. Mold	Die	Unfilled *Orders
1947					
Total	441,996	155,112	174,515	110,538	.....
1948					
Aug.	32,136	9,883	13,174	8,526	68,334
Sept.	35,877	11,822	13,353	10,218	66,773
Oct.	35,542	11,733	13,216	10,158	65,538
10 mos. total	856,146	773,289	49,106	10,562	.....
Nov.	34,550	11,410	13,012	9,640	63,767
Dec.	31,836	10,335	11,589	9,290	59,154
Total	424,490	139,781	161,334	118,738	.....
1949					
Jan.	29,142	9,702	10,386	8,490	55,580
Feb.	27,228	9,286	9,339	7,795	52,916
Mar.	27,478	9,348	9,386	7,999	50,508
Apr.	23,801	8,041	8,353	6,876	45,638
May	21,392	7,582	7,293	5,994	41,460
June	23,261	8,668	7,790	6,257	38,159
July	18,621	6,311	6,592	5,180	36,993
Aug.	23,997	9,048	8,326	6,119	38,130
Sept.	27,546	9,923	9,491	7,623	38,179
Oct.	29,071	9,634	9,923	8,908	37,881
10 mos. total	251,537	87,543	86,879	71,241	.....

Steel

(Net tons)

	Shipments Total	Shipments For Sale	Unfilled *Orders
1947			
Total	1,625,055	1,203,504	.....
1948			
Aug.	140,223	107,538	472,481
Sept.	149,222	112,551	447,972
Oct.	152,983	114,819	424,460
10 mos. total	1,351,431	1,108,735	.....
Nov.	146,835	110,275	395,013
Dec.	157,395	116,285	354,458
Total	1,760,032	1,335,295	.....
1949			
Jan.	140,577	103,503	338,889
Feb.	135,042	99,425	320,202
Mar.	138,889	102,027	284,754
Apr.	119,953	83,277	250,506
May	106,178	75,537	191,473
June	116,052	84,112	173,237
July	78,710	50,124	155,494
Aug.	89,964	59,412	143,566
Sept.	86,502	55,853	127,664
Oct.	70,690	48,263	124,817
10 mos. total	1,082,557	761,533	.....

Magnesium

(Thousands of pounds)

	Shipments Total	Shipments For Sale	Unfilled *Orders
1947			
Total	7,693	7,050	....
1948			
Aug.	703	655	2,834
Sept.	745	700	3,206
Oct.	708	650	3,070
10 mos. total	6,732	6,110	....
Nov.	728	683	3,416
Dec.	754	695	3,455
Total	8,214	7,488	....
1949			
Jan.	822	761	3,821
Feb.	813	756	3,586
Mar.	879	800	3,227
Apr.	726	669	3,234
May	778	726	2,885
June	799	759	3,025
July	689	637	3,073
Aug.	753	712	3,107
Sept.	727	691	3,015
Oct.	796	763	3,050
10 mos. total	7,782	7,274	....

* For sale only.

Malleable

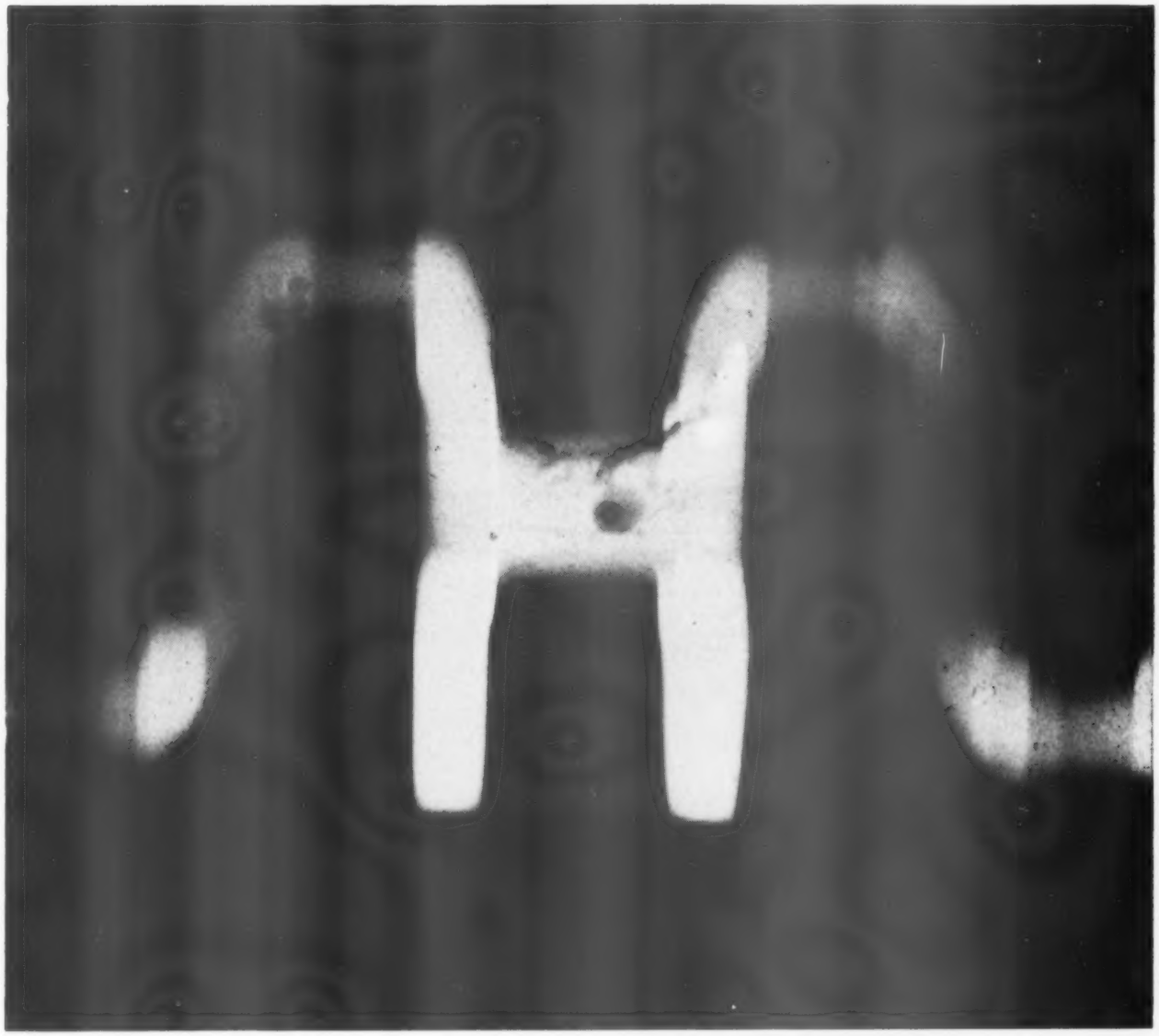
(Net tons)

	Shipments Total	Shipments For Sale	Unfilled *Orders
1947			
Total	895,054	513,228	.....
1948			
Aug.	73,272	41,201	176,824
Sept.	77,815	43,985	164,002
Oct.	81,761	44,305	158,351
10 mos. total	776,189	439,574	.....
Nov.	77,194	42,241	146,422
Dec.	79,882	43,397	137,385
Total	933,265	525,212	.....
1949			
Jan.	71,876	38,040	126,393
Feb.	66,744	35,074	118,318
Mar.	72,052	38,143	102,379
Apr.	61,329	31,728	94,958
May	54,572	27,643	78,944
June	59,597	32,639	69,865
July	44,360	23,216	70,796
Aug.	58,121	30,327	61,330
Sept.	60,488	30,646	57,512
Oct.	57,150	28,582	54,322
10 mos. total	606,289	316,038	.....

Copper-base Alloys

(Thousands of pounds)

	Shipments Total	Sand	Perm. Mold	Unfilled *Orders
1947				
Total	1,051,742	960,732	51,139	.....
1948				
Aug.	81,976	73,947	5,018	69,126
Sept.	86,973	78,830	4,999	66,574
Oct.	91,311	82,463	5,293	62,571
10 mos. total	856,146	773,289	49,106	.....
Nov.	86,497	77,751	5,107	60,892
Dec.	88,182	79,750	4,796	53,671
Total	1,030,825	930,790	59,009	.....
1949				
Jan.	76,348	68,379	4,593	48,124
Feb.	68,776	61,278	3,951	40,517
Mar.	70,173	62,557	3,927	37,646
Apr.	59,573	52,837	3,458	32,746
May	53,699	48,004	2,830	30,926
June	52,616	47,678	2,552	26,788
July	43,273	39,372	2,129	26,022
Aug.	58,055	53,203	2,929	26,071
Sept.	60,771	55,221	2,729	26,527
Oct.	58,249	52,861	2,316	23,634
10 mos. total	599,627	539,484	31,414	.....



Here's why — Radiography cuts down rejects . . . ups profits!

With radiography at his command, the bugaboo of subsurface defects need no longer plague the foundryman. For here's a vital foundry tool that enables him to detect internal discontinuities prior to the production run and before expensive machining. As an inspection device, industrial x-ray is often a swift substitute for physical test and sectioning. But its applications are much broader.

GE Industrial X-Ray has become a *development* tool. It not only diagnoses, but suggests treatment. It shows where savings can be made, designs improved, new techniques developed.

Is there a place for industrial x-ray in your business? A General Electric X-Ray engineer will be glad to talk it over. Or write for Pub. 11A-3116 "Radiography as a Foundry Tool." Address General Electric X-Ray Corporation, Dept. YY2, Milwaukee 14, Wisconsin.

GENERAL ELECTRIC
X-RAY CORPORATION

CRANE DRUM

Molded and Poured ON END

By PAT DWYER
Engineering Editor
THE FOUNDRY

Large 13-ft crane drum produced by City Foundry Division, Cleveland Punch & Shear Works Co., is posed between Carl Richmond (right), foundry superintendent, and Joe Roth (left), coreroom superintendent

THE large cast iron crane drum shown in the accompanying illustrations — 2¾-in. thick, 48-in. OD, 13 ft long and weighing 19,950 lb—recently was made by the City Foundry Division, Cleveland Punch & Shear Works Co., Cleveland, of which M. G. Thomas is general manager. The drum is one of the components for a 300-ton crane under construction by the Cleveland Crane & Engineering Co., Wickliffe, O.

Over a period of many years, the City Foundry Division has made numerous drums. The job is more or less routine. In this instance the problem resolved itself before a council meeting, which suggested an economical and yet satisfactory method for making molds and cores. Outside of the mold was formed by ramming molding sand between the pattern and the wall of a 72-in. and 60-in. circular cast iron flask, made up in 12-in. sections. The mold was taken apart, black washed on the face and dried in an oven.

End view of cast iron drum. It is 48 in. OD, has 2¾-in. metal thickness and total weight of 19,950 lb

Particular care was observed in keeping the pattern in the center of the flask. A uniform thickness of sand is essential between pattern and flask. Where this thickness varies to any conisderable extent, either through carelessness or ignorance, the different thicknesses affect the cooling rate of the metal. The casting will be bent instead of being straight. The same rule, of course, applies to a case where the main core is off center for any reason. The thin side of the casting contracts first and pulls the casting out of line. Later when the thick side starts to contract, it is prevented by the other side. Therefore, the casting is in a strained condition and is in line for rejection. The casting must be straight, solid and clean.

In the machine shop a spiral groove is cut in the face from end to end. This groove is for the guidance of the steel cable suspended from the drum and terminating in the block and hook to which loads are attached when the crane is in service.

In this connection it is interesting to note that the mold was adjusted and gated on top through three 1¼-in. gates set at a slight angle to impart a whirling motion to the metal as it rose in the mold. Each gate opposite an arm was adjusted to deliver metal first to the bottom of the mold and then gradually fill the mold to the top where three risers occupied space opposite to the gates. This choice of gates was deliberate.

In a method formerly employed on other and smaller drums a long sprue extended from the runner basin to the bottom of the mold. It was connected to the drum at the bottom,

the center and the top. The method was not always satisfactory. Small or large spongy areas were exposed during the machining operation. These were caused by small quantities of foreign material which developed during the pouring operation.

Theoretically, these small pieces were supposed to float to the top. Unfortunately, the theory is not always realized. The gobs of foreign material anchor themselves to the mold or core wall. The rising metal flows past and through them. They remain undetected until they are exposed in the machine shop.

Describes Molding Method

The accompanying illustrations, showing parting lines, position of arms and other details, indicate in a general way the method adopted in making the mold. The bottom flask section, or drag, was adjusted flat and level and filled with sand to a predetermined depth. After the sand was rammed, a board with a jog at each end and resting on the flask flange, was employed to sweep a flat surface. The large and separate end of the pattern was set in the center and surrounded with rammed sand. A parting was formed at this level and then the half length barrel pattern was adjusted in place. With the sand rammed to the top, the pattern was drawn about 2 ft. With this treatment the pattern remained truly straight and central, until it was drawn to the proper height, which included shrinkage allowance of 1/12-in. per foot. This allowance, instead of the standard ⅛-in., per ft., was based on experience which showed that a casting filled with dry sand cores did not shrink the usual or standard amount.

The cope with gate pins, risers and vent pipes in place was rammed, lifted off, rolled over and finished in the usual manner. The pattern was removed from the mold. The mold was lifted off in sections and the face of each section was black washed. The sections were loaded on cars and thoroughly dried in the oven.

While the mold was under construction, the segment cores and the main core in four sections were made in the coreroom. In addition to the reinforcing vertical and horizontal rods and lifting hooks, each core section was filled with coke to facilitate escape of gas. A continuous passage extended from the bottom to the top. In the assembled state, the main barrel core was designed to resist pressure from all directions.

The dried drag was set up solidly true and level, a set of segmental cores was placed on the bottom to form the lower hub and six heavily ribbed arms, terminating in extensive brackets at each end. Other cores were designed to form similar hubs, arms, ribs and brackets at the center and upper end of the casting. Mold sections and cores were assembled alternately. Four guide sticks or thickness pieces, spaced 90 degrees apart, were held against the face of the mold to guide each core section into place. The cope was replaced on top and clamped and the runner basin, risers and vent openings were built up.

Metal for the casting, containing 35 per cent steel, was melted in one of the 54-in. twin cupolas recently installed. Blast was supplied by a modern type blower equipped with automatic control which regulated the volume and pressure in accordance with atmospheric conditions. A test bar from metal in the ladle showed the following analysis: Total carbon 3.12 per cent; silicon 1.76 per cent; sulphur 0.083 per cent; manganese 0.70 per cent; phosphorus 0.13 per cent. Tensile strength was 36,000 psi.

After the casting was poured, the cope clamps were removed to allow for initial expansion of about 1 in. Later, when normal contraction set in, the casting sank back to the correct and anticipated length, 13 ft.

The outside of the casting stripped clean, but a considerable amount of work was involved in removing the core from the interior. The cores, heavily reinforced with vertical and horizontal rods, presented a hard and almost impenetrable mass. Facing sand and core sand were bonded with a pitch base binder.

MERRY CHRISTMAS: Hamilton Foundry & Machine Co., Hamilton, O., continued a tradition in December, 1949. Just prior to Christmas, Peter E. Rentschler, company president, handed each employee a bag of silver dollars at his place of work. The amount of money in each bag depends upon the employee's length of service. In top photo, Luther Godsey, molder, receives his bag. Each employee also received a basket of food including a dressed chicken

By PAT DWYER

Drawings by RICHEY

ADVENTURES OF Bill

SOMEWHERE, sometime, I don't remember where or when, and what difference does it make anyway, I read a statement to the effect that married couples, and others closely associated for many years, develop a species of sixth sense through which the party of the first part knows in advance what the party of the second part is going to say. All this, mind you, before the aforesaid party of the second part opens his or her mouth.

The statement may or may not be true in certain cases. I would not know about that, but certainly it does not apply to Bill. We have been closely associated for many years, but even after a prolonged period of silence, I have not the faintest idea of what he has in mind, or on what target he is thinking of laying a few arrows. Sometimes the cloth yard shafts whang into the target in a manner that makes you glad you are not standing behind it. At other times the arrows float in as softly and gently as they do in an archery tournament at one of the more exclusive ladies' finishing schools, where the correct costume and stance are the only really important factors. The other night he was in a gentle and reminiscent mood.

"Sometimes," Bill said, "either voluntary or through-ah-outside pressure I listen to sermons and other forms of public speaking. Some of the performances are so-so. Others are in the stinkeroo or minus *D* bracket. Occasionally, with mixed admiration and envy, I listen to a man who has something to say, and knows how to say it. Unfortunately, the men in the third classification, able and competent to discuss any subject from anatomy to zoology in a pleasing voice and in a finished and scholarly manner, are moving toward extinction like the dodo, the great auk, the perrydacktills, or whatever you call the creatures—big as a compound, articulated, mountain-climbing locomotive. I don't know what purpose they served, but most assuredly even the most rabid bird and animal lover was not tempted to keep one on a leash or in a cage for a pet.

"Coming back now to the real public speakers, the lads who can dish it out, partly as a result of long training and study and partly through a natural gift for that kind of thing. Words flow from these men as easily and smoothly as the water in a small meadow stream where, at the mature age of 11, I caught my first trout. Bare feet, of course—on me, not on the trout—and the remainder of the body covered with a patched pair of pants and a little short cotton shirt, all fully air conditioned. In later years I often have wondered why all young fishermen do not contract pneumonia.

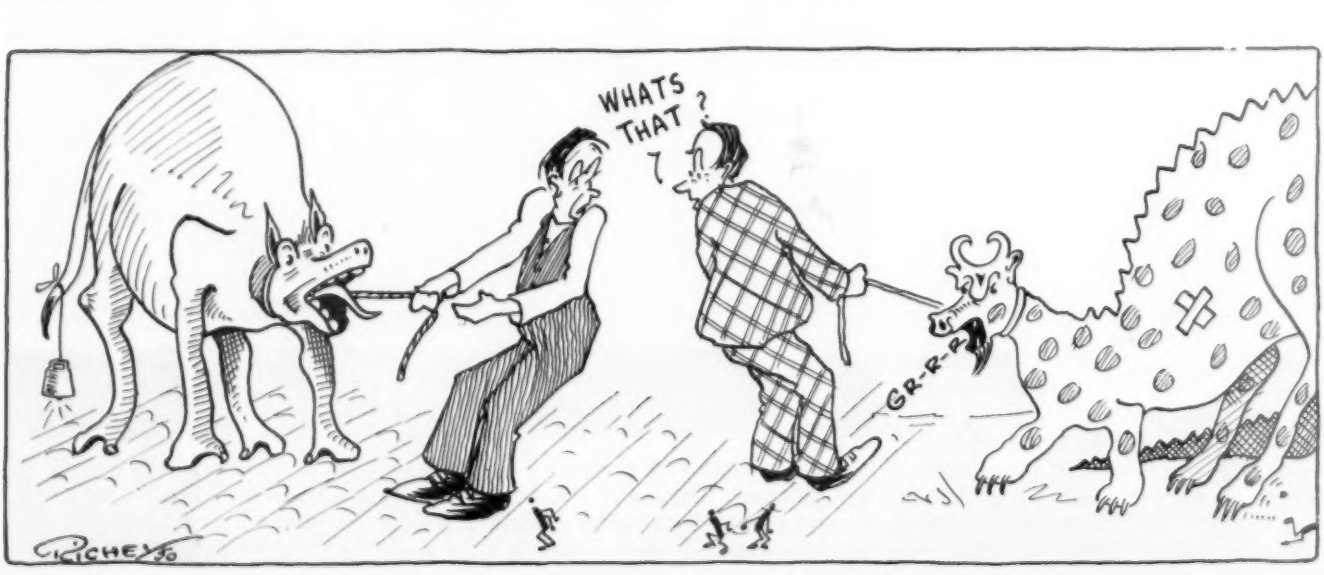
"Catching that trout was the first real thrill of a lifetime. On a percentage basis I should be inclined to estimate conservatively that the electric shock set up by the first mighty tug on the line, exceeded by a comfortable margin the voltage of my first bungling contact with the inviting and tender lips of a shy and blushing angel of delight in a sprigged muslin dress. As a plain matter of fact, she was not nearly as cooperative as—well—as she might have been. I was astonished and humiliated to discover she had a full complement of teeth and claws and a rather neat upper-cut. She was about as amiable as a famished wildcat afflicted with the toothache and stomach ulcers. A regular ju-jutsu Judy!"

"Before you dive any deeper into the prehistoric mill pond and dredge up a few waterlogged smart sayings from the period when you went around in a little red flannel petticoat designed to prevent the fairies from snatching you into their underground kingdom, would you mind telling me what prompted this rigmarole about public speakers, fishing costumes, fish obligingly waiting to be caught, and no doubt beautiful ju-jutsu Judy."

"Take a look at the calendar, me boy. The coming month is February."

"So what? The calendar also shows March, April, May and all the others up to December. I trust you will pardon my apparent density when I claim I cannot see any earthly reason for selecting February as a springboard of a runway for a take-off into

(*Continued on page* 162)



Lay-deez an' gen-l-men: In this koh-nah Sikem 2476 poun's. In this koh-nch Sockem 3000 poun's. Shake han's boys

It stops profit leaks in the cleaning room

LIKE A CHAIN that is no stronger than its weakest link, a foundry can not attain peak efficiency—and earning power—with jumbled piles of castings strewed around the cleaning room.

In most foundries the time and the cost of handling castings from the shakeout through the cleaning room can be—and should be reduced.

Apron Conveyors of proper design, and properly used, permit cleaning room and inspection operations to be synchronized with the tonnage passing over shakeouts—eliminate re-handling—and produce an orderly "flow" of castings similar to the controlled flow of sand through a sand conditioning plant—or to the control of molding, pouring, cooling and shaking out made possible with a run-around mold conveyor.

Slow speed Apron Conveyors, with or without hoods, provide one of the few generally approved methods of cooling castings from shakeout temperatures of around 1500°F., to the temperatures required for mill cleaning or hand sorting.

Apron Conveyors with heavy duty flat tops and no sides, that permit the easy loading and unloading of castings, make ideal chipping conveyors.

Let the Bartlett-Snow engineers, with their wide familiarity with the needs of practical day to day foundry operation, work with you in making your cleaning room as efficient and smooth running as other parts of your foundry. The C. O. Bartlett & Snow Company, Cleveland 5, Ohio. Engineering representatives in New York, Baltimore, Detroit, Chicago.

BARTLETT-SNOW
CLEVELAND 5, OHIO

DESIGNING AND CONTRACTING ENGINEERS

For the Foundry Industry

SAND, MOLD AND CASTINGS HANDLING EQUIPMENT

Having SLIDE RULE trouble?

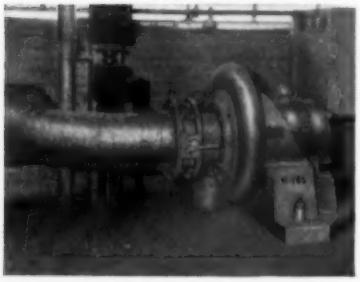
When the problem is moving air or gas, turn to *R-C dual-ability* for accurate, dependable answers

That's one job we know, inside-out. For almost a century, we've been air-and-gas specialists, exclusively. Without being immodest, we think our engineers are the best informed in the industry, on blowers, exhausters, gas pumps and related equipment.

They have an extensive line to draw on, too. They make unbiased recommendations between Centrifugals and Rotary Positives—we're the only company offering this *dual choice*. With capacities ranging from 5 cfm to 100,000 cfm, we can supply standard units closely matched to the job, for efficiency and economy.

As to how R-C equipment performs, our old-time, repeat customers are the best answer to that. They'll testify that you will reduce your buying and operating problems when you call on R-C air-and-gas specialists.

ROOTS-CONNERSVILLE BLOWER CORPORATION
502 Madison Avenue, Connersville, Indiana



CENTRIFUGAL

Type OI Centrifugal Blower, driven by 40 hp motor. Capacity 4,400 cfm.

Type RCS Blower, typical of the 14 standard R-C Rotary Positive designs of cupola blowers.

ROTARY

ROOTS-CONNERSVILLE

BLOWER BUILDERS R.C. SINCE 1854

ONE OF THE DRESSER INDUSTRIES

(*Continued from page* 160)

ancient history."

"Well," Bill remarked charitably, "we all have our limitations. Some people are quick, while others, giving me the eye, are not quite so nimble on the uptake. I'll just give you a hint and maybe—I don't say positively—but maybe you can carry on from there. February marks the 31st anniversary of our joint first appearance in the pages of THE FOUNDRY. Your calendar brought the date to mind. Then, by what a little liked school master was fond of referring to as association of ideas, my mind drifted back farther and farther through the years and finally arrived at my first fishing adventure. There is the whole bloomin' kettle of fish in a nutshell.

"Reference to the old-time teacher is what you might call a gross understatement. He was an autocratic bully, very fond indeed of touching up the little boys with a hard cane, or with a long, stinging leather strap. The only time I ever really enjoyed his company was the day the class was granted a half holiday to attend his funeral. One of the older boys with a happy gift for rhyming, composed a beautifully scurrilous poem on the happy event. The poem was copied extensively and clandestinely and was greatly enjoyed and admired by one and all."

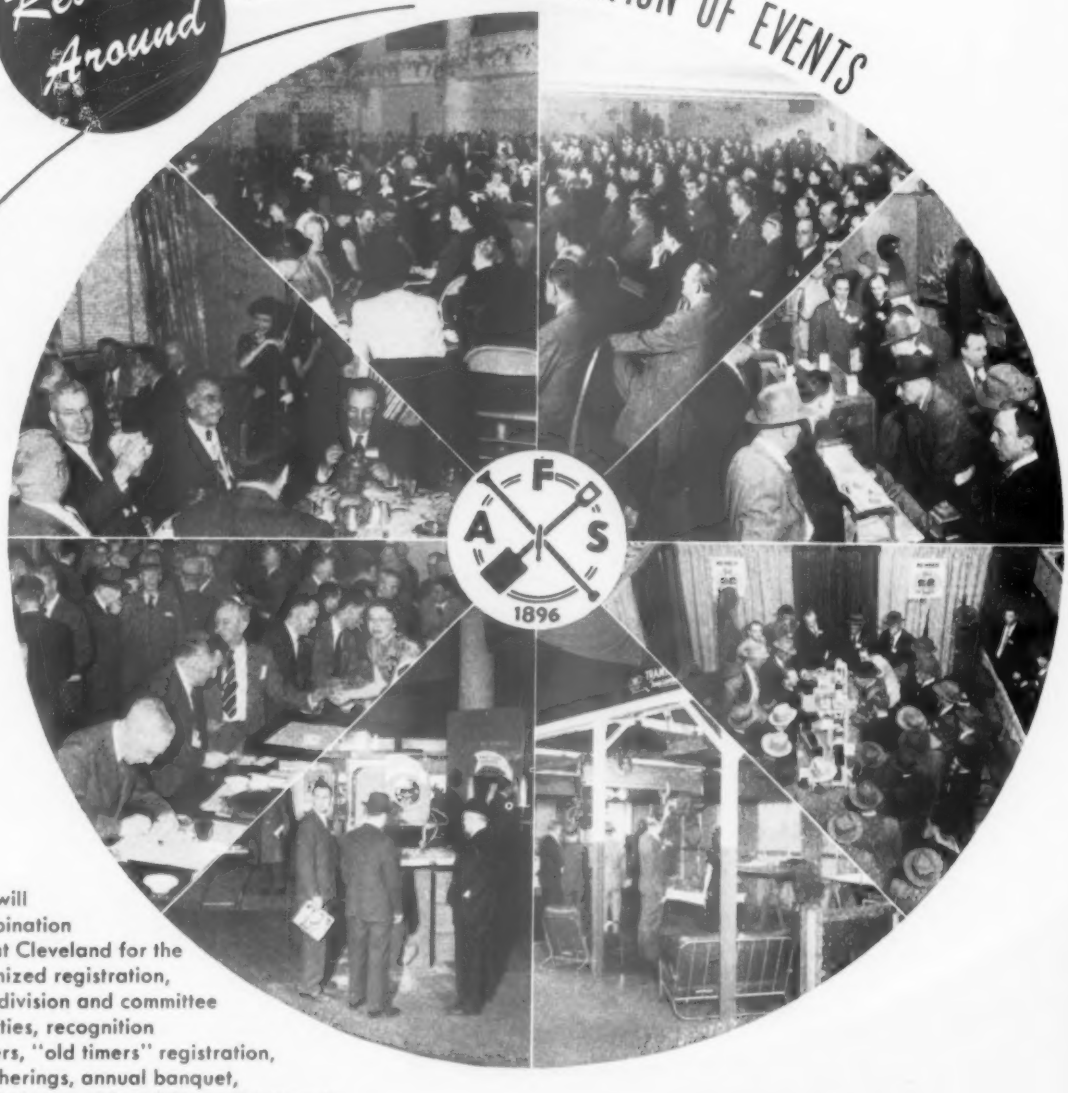
"Now that you mention it," I said, "I believe you are absolutely correct. I wrote and submitted the first story in November, 1918, while recovering from an attack of the Flu, or as it was known in those days Spanish Influenza, an epidemic that spread across the entire country and claimed about as many victims as shown in the casualty lists of the AEF during World War I. The story was published in the February, 1919 issue of THE FOUNDRY, and with only two exceptions, the series has been a regular feature up or down—take your choice —to the present."

"You do not need to tell me," Bill said. "I supplied the dope for all of 'em. All you did was to quote me and then piece the thing out by adding a few more or less unrelated observations at the beginning and at the end. As I remember, that first story presented my carefully considered opinion on how the ancient workmen might have cast the great pillars and other huge bronze castings for Solomon's Temple."

"All water over the dam. All far away and long ago. Have you had a chance to sink your teeth into any problems recently?"

"I had an inquiry recently from a man who wanted information on chilled castings. Here, I'll read his

(*Continued on page* 165)

A SUCCESSFUL CONVENTION *Revolves Around* THE CORRECT COMBINATION OF EVENTS

Foundry Congress and Show May 8-12, 1950

Balanced activities will blend into a winning combination May 8-12, when AFS meets at Cleveland for the 54th Annual Convention. Organized registration, round table meetings, division and committee luncheons and dinners, ladies activities, recognition of apprentice contest winners, "old timers" registration, international events, sectional gatherings, annual banquet, impromptu get-togethers, and industry-wide exhibits will integrate in a 5-day Meeting that already has provoked unprecedented interest by the firms that will exhibit . . . by the authors and speakers who will contribute to a diversified technical program . . . by the thousands of foundrymen-members and guests who will converge in Cleveland to renew old friendships, to see and to learn about the latest developments pertaining to improved foundry techniques and application. The vast halls and numerous meeting rooms of the Cleveland Public Auditorium will assume the proportions of an open market for foundry equipment and supplies . . . of a modern laboratory for unfolding processes of refinement to create varying properties in new and old metals . . . of an international open forum for the discussion and evaluation of the latest procedures relating to the development and production of metal castings. Like other AFS Conventions and Exhibits, this 54th Meeting will bring together management and operating men, metallurgists and designers, manufacturers and customers . . . *manufacturers and prospective customers.*

Activities

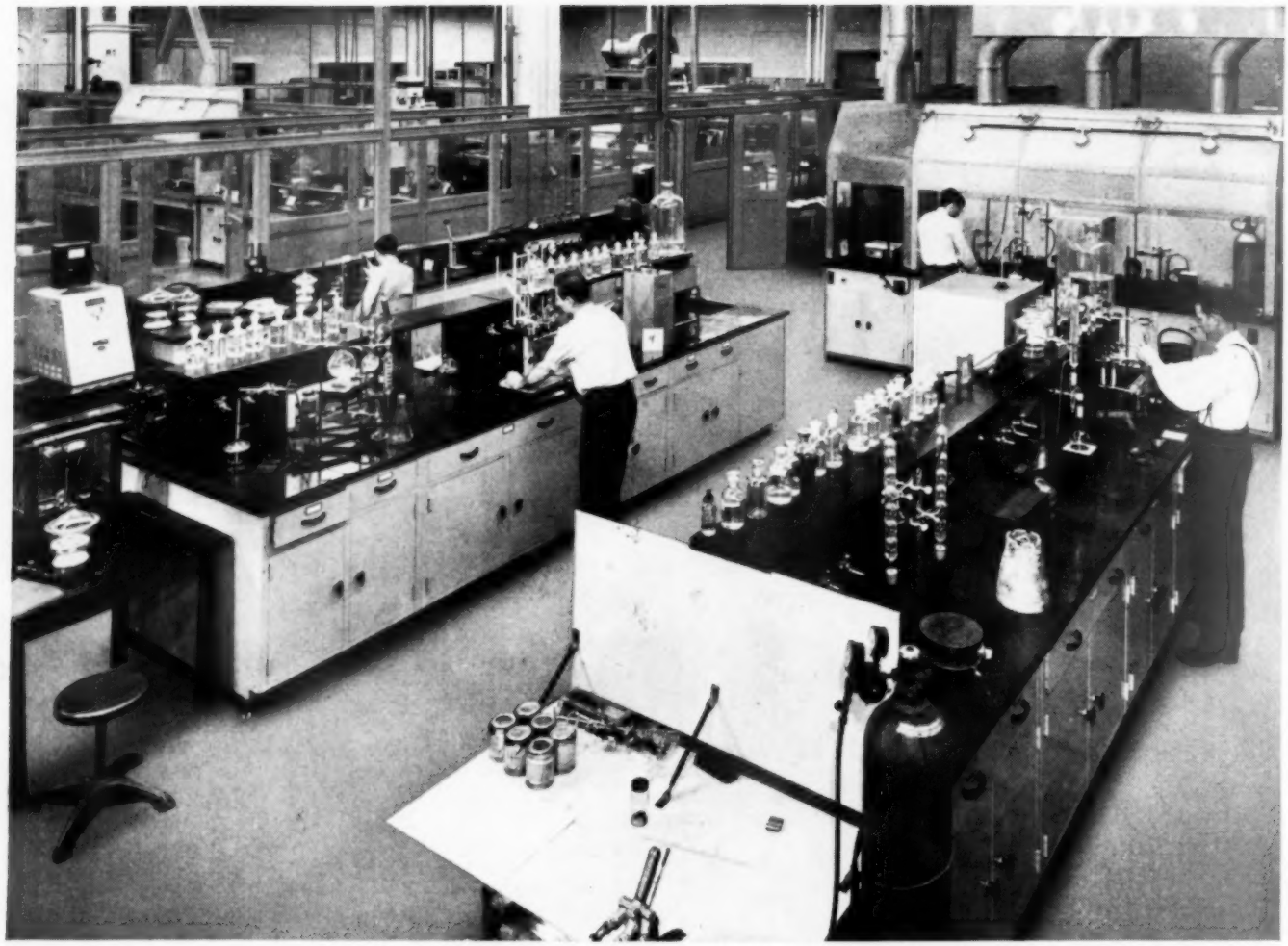
during the week of May 8-12, 1950, will exert far-reaching influences on the entire metal castings field — foundrymen and foundry interests are invited to participate in this 5-day Foundry Congress and Show for the good that will result generally to all those interested in the manufacture and further refinement of cast products.

54*th Annual A.F.S. Foundry Congress and Show*

Cleveland — May 8-12, 1950

AMERICAN FOUNDRYMEN'S SOCIETY

222 West Adams Street • Chicago, Illinois



Making laboratory analyses of grinding wheels and abrasive materials

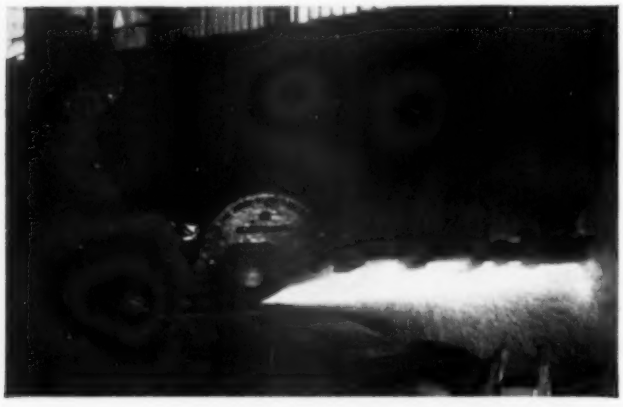
This is your grinding wheel laboratory

This is just one corner in the immense research and development laboratories of United States Rubber Company at Fort Wayne, Indiana.

Here "U. S." Abrasive Engineers work to lower your grinding wheel costs. They delve into every phase of bonds and abrasives, developing wheels that are more economical for snagging castings.

Their development work has revealed 5,000,000 possible combinations of size and construction. This means that they can produce the exact wheels you need for your conditions.

Take advantage of the "U. S." grinding wheel service. Write to address below.



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(*Continued from page* 162)

letter to you.

We operate a 700-lb capacity cupola and foundry in connection with a repair and machine shop. Frequently customers require white iron castings. Up to the present we have not been successful. Chill sections on the molds are approximately three times as thick as the casting sections. We shall appreciate information as to types and sources of supply of ladle admixtures which would prevent formation of graphitic carbon, assuming that our problem is high silicon content. Iron charges average 80-85 per cent new cast iron scrap and 15-20 per cent returns from the foundry. Please advise us as to whether we should continue using the chills with suitable ladle mixture. Also the amount of admixture required per 100 lb iron. We also shall appreciate advice on whether or not we should continue to use ferromanganese bri-

Peace that passeth all understanding

quets to counteract increase in sulphur content resultant from continued use of 20 per cent return scrap from the foundry. It is possible to achieve white iron hardness through addition of manganese, either in the cupola or in the ladle.

"I wrote him that the following extract from *Principles of Iron Founding* by the late Dr. Richard Moldenke seems to cover the situation. Unfortunately, the book now is out of print, or I should suggest—warmly—perusal of the entire chapter. His communication indicates that he has not studied or practiced the operation of a cupola. Nothing in this to promote a feeling of grief. Thousands of men active enough in other branches of the foundry field never had occasion to study or qualify in the melting field. The noted authority Dr. Moldenke now takes over:"

The property of some irons to chill when poured under conditions insuring very rapid abstractions of heat is very important, and is taken advantage of where surfaces of great hard-

(*Continued on page* 168)

At Personal Products Corporation, *this "CJ" Pangborn Dust Collector eliminates need for an extra boiler and recovers a ton of valuable material every eight hours!*

How PANGBORN DUST CONTROL

SAVES WINTER HEATING COSTS

for Personal Products Corporation

PANGBORN Dust Control *does more* than stop dust, *does more* than recover valuable material at Personal Products Corp. The way E. W. Jochim, manager of Personal's Chicago Plant, figures . . . Pangborn Dust Control saves the *cost of an additional boiler!*

Here's how:

With an ordinary system, dust laden air at the Chicago Plant would be exhausted outside. In winter, *35,000 cubic feet of precious heat a minute,* as well as dust, would be thrown away. An extra boiler for *heating alone* would be needed to make up the heat loss!

But with Pangborn Dust Control, *there is no heat loss!* In winter, heated factory air is *so clean* it can be recirculated throughout the plant. There is no need for an extra boiler . . . the dust problem is solved and *a ton of valuable material recovered every eight hours!*

How much can you save?

Just like Personal Products, chances are you can *save money* in more ways than one with Pangborn Dust Control. Find out now . . . a free Pangborn Dust Survey costs you nothing, carries no obligation. Get the details; write for Bulletin 909A to: PANGBORN CORPORATION, 300 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Dust Control and Blast Cleaning Equipment

STOP THE DUST HOG

from stealing profits with

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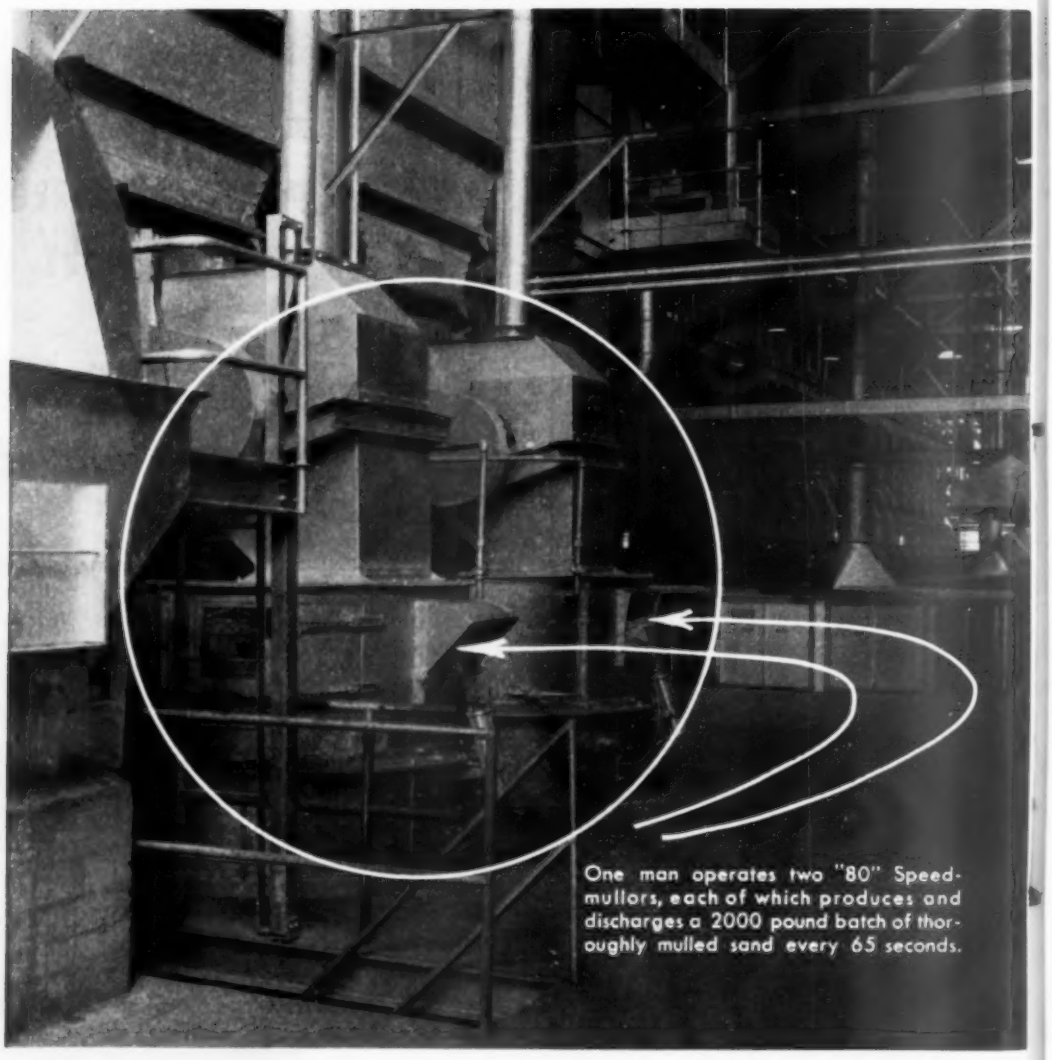
DUST CONTROL

Over 500 Tons OF THOROUGHLY MU



One man operates two "80" Speedmullors, each of which produces and discharges a 2000 pound batch of thoroughly mulled sand every 65 seconds.

B&P

SPEEDMULLOR

FOR FASTEST, MOST THOROUGH MULLING!

LY MULLED SAND PER DAY!

NEW IDEA, prominent farm implement builder, selected Speedmullors for all sand preparation in their new foundry.

New Idea Division of Avco Mfg. Corp., Coldwater, Ohio recently completed a new, modern mechanized foundry, one of the most advanced plants of its type. They chose Speedmullors for the preparation of all molding and core sand.

Two Model "80" Speedmullors supply all of the molding sand used—completely mulling this foundry's daily requirement of over 500 tons.

In the core room, New Idea depends on a Model "40" Speedmullor to prepare all of their core sand.

Another vote for B&P equipment is New Idea's choice of Sandslinger ramming for their completely mechanized husking and snapping roll molding unit.

If your foundry uses Speedmullors, you don't have to be shown . . . but, if you are still using conventional-type mixers let us show you why New Idea and hundreds of other companies have chosen Speedmullors. You'll find that "Speedmulling" produces a superior mulled sand, produces it many times faster then any conventional mixer, *and more economically*. Let us prove this to you—write today and we will make arrangements for you to *see* Speedmullor operation at a nearby foundry.

BEARDSLEY & PIPER

Division of

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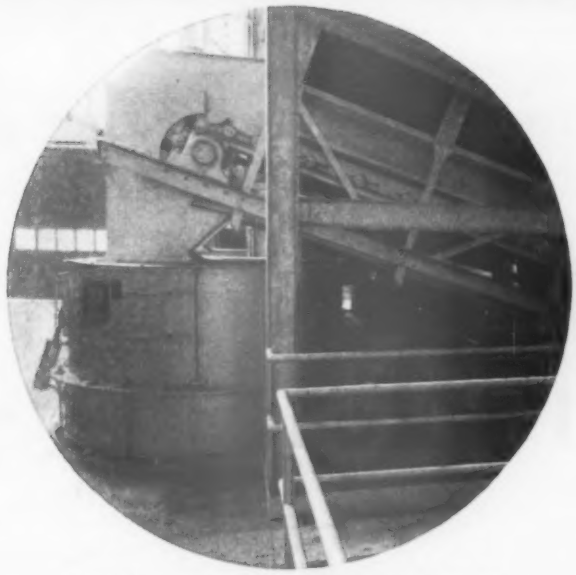
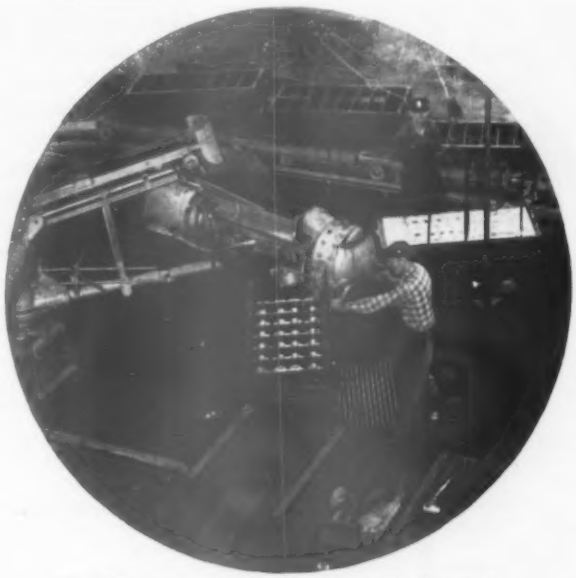


Sand is measured into the Speedmullors at the beginning of each 65 second cycle by apron conveyors. The thoroughly mulled sand from both mullors is discharged into a common hopper mounted over an under-floor transfer belt.

One Model "40" Speedmullor supplies all of the core sand required for New Idea's large daily core production.



The fully mechanized "slinger" unit. Medium and large size molds are rammed at high speed using four B&P Champion Speed-Draw Machines mounted on a sixteen foot diameter B&P Turntable.

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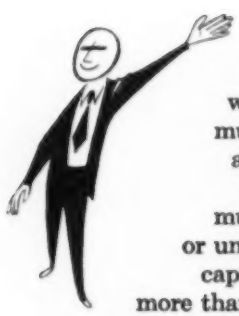
THE MULBARO

Mulling mechanism is raised and lowered by auxiliary hoist permitting several barrows to be used alternately.
Top portion contains entire mulling mechanism: totally enclosed motor, gear case, mulling wheels and plow.
Plow blends and directs sand into path of rubber tired mulling wheels where it is thoroughly mulled.
Available in two sizes: 3½ and 7 cubic foot batch capacities.
1. Sand shoveled into Mulbaro's knee-high barrow.
2. Barrow easily wheeled to mulling mechanism.
3. Barrow positioned under mulling mechanism.
4. Mulbaro quickly and thoroughly mulls.
5. Mulling mechanism raised from barrow.
6. Mulled sand wheeled to molder or coremaker.
Less sand handling – sand is loaded only once – into the knee-high barrow. After mulling, sand is carried in same barrow, directly to molder or coremaker.



The *really* portable Mulbaro is easily moved about the foundry or core room and the sand is mulled in the same barrow in which it is brought to and taken from the mullor. The sand is handled only once! With an additional barrow or barrows, the Mulbaro mulls almost continuously. While the sand is being mulled in one barrow another is being loaded or unloaded. Thus the Mulbaro offers the capacity of two or more mullors for slightly more than the price of one . . .

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(*Continued from page* 165)

ness and polish are required. . . .

Since the heat in the interior of a casting being poured into an iron mold cannot be abstracted as that from the surface, it is perfectly possible to have a gray fracture interior with only a rim of white iron. Thickness of this rim and the change from white to gray will depend on the percentage of silicon present in greatest measure, and the sulphur, phosporus, etc., only if very pronounced. It is assumed that the iron mold is a sufficient thickness to absorb the heat of the molten metal readily. Possibility of making castings with a strong and yet machinable interior and a hard face of sufficient depth to give good wear in service has meant the development of a number of lines of great importance including car wheels, chilled rolls, rock crushers, grinding mills, etc.

Inherited knowledge that white or mottled charcoal iron produced highly satisfactory castings, accounts for the belief even today that, for these castings, charcoal iron is actually essential. As a plain matter of fact, the same depth of chill is obtained with coke and anthracite iron for the same silicon content. Coke irons never are blown as cold as charcoal iron. This means that very low silicon coke irons are not made ordinarily, at least for foundry consumption. Where a low silicon iron is offered—one which would give a proper chill in the casting—the chances are that it is an *off iron*, the result of a furnace irregularity, and has either an abnormaly high sulphur content, or probably is highly oxidized.

Addition of low silicon sprues from the previous day's heat, also steel scrap, will run the silicon down below the point where a deep chill is indicated. Best hardness results usually are obtained with the total carbon quite high. . . .

CHILL IS BASED ON COMPOSITION

Silicon in Mixture, %	Silicon in Casting, %	Chill Depth, in.
1.20	0.90	½
1.10	0.80	⅝
1.00	0.70	¾
0.90	0.60	1
0.85	0.55	1¼
0.80	0.50	1⅜
0.75	0.45	1½
0.65	0.35	1¾
0.60	0.30	2
0.50	0.20	2½
0.40	0.10	3

To correct the metal in the ladle or furnace except in one instance is not difficult. If the furnace has not yet been tapped, the addition of a suitable amount of ferrosilicon, or of very low silicon pig iron, after thorough rabbling, either will correct the difficulty or show how much more has to be added before making another test. Where the cupola metal is in the ladle the silicon deficiency may be overcome by adding powdered ferrosilicon (ordinarily the 50 per cent variety). In special cases the 75 per cent alloy is preferable. Where the chill is a little too light in cupola metal which cannot be tested before tapping, the addition of ferrochrome is about the only way to correct the metal in the ladle, even though the hardness of the chilled part is not everything desired. Low silicon irons

cannot be added in sufficient quantity. They cool the metal too much in the ladle. Heavy additions of ferromanganese—to get a manganese chill — is undesirable. The chill is neither strong nor hard. Since the best chilled castings are made from air furnace metal, you may not be interested in any further quotation from this section.

Plan Conference On Materials Handling

Purdue University, West Lafayette, Ind., will hold a materials handling conference Feb. 20-21. H. T. Amrine, associate professor of industrial engineering, Purdue, is general chairman. Registration fee of $20 includes cost of banquet ticket and a copy of the proceedings.

The program follows:

Monday, Feb. 20

10:00 a.m.—Conference welcome, A. A. Potter, dean, Schools of Engineering, Purdue.

"Materials Handling—A Profession," W. W. Phillips, Eli Lilly & Co., Indianapolis.

"Profits In Short Run Production by Materials Handling," M. L. Triplette, Carrier Corp., Syracuse, N. Y.

2:00 p.m.—Chairman, R. Kennedy Hanson, Materials Handling Institute Inc., Pittsburgh.

"Statistical Approach to Materials Handling," Irving W. Burr, professor of mathematics, Purdue.

"Problems Solved by Statistical Methods," Guy Parkin, Minnesota Mining & Mfg. Corp., Minneapolis.

6:30 p.m.—Banquet, O. S. Hulley, associate professor of industrial engineering, Purdue, presiding. "China—the Third World," Mrs. Mildred Fitch, professor of government and economics, Purdue.

Tuesday, Feb. 21

9:00 a.m.—Chairman, D. C. Rhodes, Pitman-Moore Co., Indianapolis.

"Materials Handling Costs—How Are They Determined," Robert W. Field, professor of industrial engineering, Purdue.

"Efficiencies Effected by Materials Handling," Lee Russell, Brown Forman Distilleries, Louisville. W. J. Greer, Eli Lilly & Co.; and E. T. Riter, Soya Products Division, Glidden Corp., Chicago.

1:30 p.m.—Moderator, H. F. Owen, associate professor of industrial engineering, Purdue.

Panel discussion, all program speakers will be panel members. Summarization, W. B. McClelland, Clark Equipment Co., Battle Creek, Mich.

Book Review

Metal Cleaning Bibliographical Abstracts (1893-1949), prepared by Jay C. Harris, 72 pages, 6 x 9 in., paper covered, published by the American Society for Testing Materials. Price, $2.75.

First compilation of data concerning metal cleaning was by Mr. Harris, Monsanto Chemical Co., and Robert B. Mears, Carnegie-Illinois Steel Corp., in 1943, and dealt chiefly with cleaning aluminum. Subsequent issues have been made and with interest in the subject increasing, it was felt a more systematic treatment was desirable. Therefore all previous material has been consolidated and a large group of additional references added with subject, author, specification and patent indices provided. However, the majority of the references in this book deal with chemical cleaning methods.

COMPLETE SAND CONDITIONING WITH MAGNETIC SEPARATION

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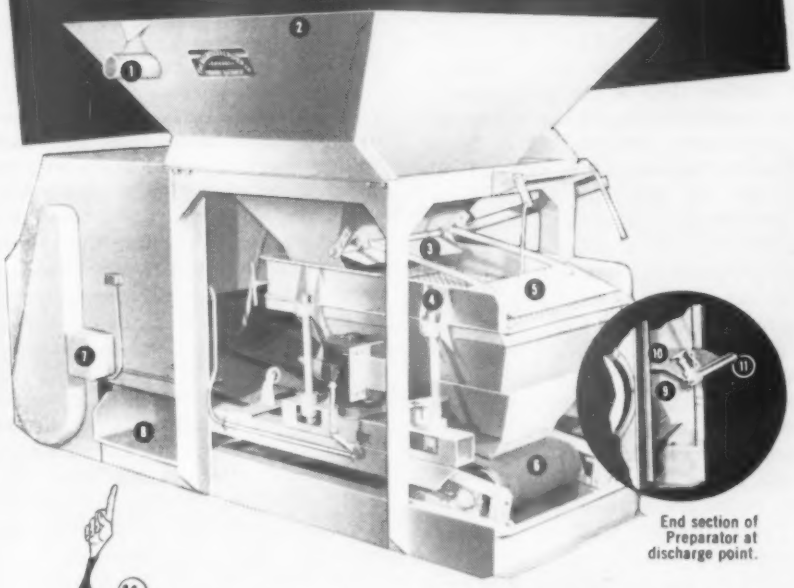

End section of Preparator at discharge point.

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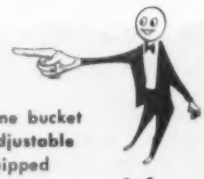
Newly designed and streamlined, the Preparator provides your foundry with an efficient, dependable, heavy duty, portable sand conditioner. This one machine screens, breaks lumps, magnetically separates, aerates and discharges sand up to 35 feet into pile or bin. Load centered trunnions permit easy movement by crane. Rugged construction assures years of service, even with the roughest of treatment. Completely conditions up to sixty tons of sand per hour!

the PREPARATOR

HOW IT OPERATES



Preparator easily lifted by Trunnions [1]—and moved to any desired location by crane. Shakeout sand is loaded by crane bucket or loader into large open top hopper [2] and feeds through adjustable gate opening [3] onto heavy duty Gyratory Screen [4] equipped with adjustable lump breaker [5]. Screened sand drops onto belt conveyor [6] and passes over magnetic pulley [7] which separates tramp iron into scrap box [8]. The cleaned sand falls onto drum type aerator [9] which discharges it to any distance up to thirty-five feet. The adjustable deflector plate [10] controls the distance the sand is thrown. The water spray [11] at discharge point, provides final tempering.

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Rapid, Direct Determination of

NICKEL in BRASS and BRONZE

By C. GOLDBERG
New England Smelting Works Inc.
West Springfield, Mass.

THE determination of nickel alone in brass and bronze, rather than a complete analysis, is often called for in control work. The customary procedure has been to dissolve the sample in nitric acid, filter the tin and antimony oxides and remove the copper by electrolysis. The nickel is then determined colorimetrically. Titration of the copper ammonium complex with potassium cyanide has been used but it is not very sensitive.

Much time would be saved if the nickel could be determined in the presence of copper, and many attempts [1,2] have been made to precipitate nickel as nickel dimethylglyoxime in the presence of copper. However, some copper is always co-precipitated. It should also be noted that .06 nickel or less is not precipitated quantitatively by dimethylglyoxime, even after long standing.[3] It seemed that a rapid, accurate nickel determination would best be accomplished colorimetrically.

As a result of many experiments the procedure finally adopted calls for the separation of copper in dilute sulphuric acid solution, aluminum being used to displace the copper.[4] An aliquot of the filtrate is then used for the colorimetric determination of nickel, according to the well-known dimethyglyoxime colorimetric method.[6]

Reagents Used:

Sulphuric acid C.P. 1 per cent solution.

Nitric acid C.P. (1:1)

Sulphuric acid C.P. concentrated.

Ammonium hydroxide C.P. (1:1).

10 per cent citric acid solution.

Iodine solution. To 25.0 g KI dissolved in 50 ml distilled water add 13.0 g I_2 and dilute to 1 liter.

1 per cent alcoholic solution dimethyloglyoxime

Procedure—Transfer a 0.5 g sample to a 500 ml Ehrlenmeyer flask and add 10 ml nitric acid (1:1). Heat to complete solution. Carefully add 10 ml concentrated sulphuric acid and take to strong sulphur trioxide fumes (hood), swirling the flask to prevent spattering. Cool and carefully add 65 ml distilled water. Warm until all copper sulphate is in solution and insert an aluminum strip, 1 inch wide into the flask, folding the top of the strip over the lip of the flask. Boil 5 min. Wash down the strip and filter through a 42 Whatman or similar filter paper. Wash the copper and any lead sulphate twice with 1 per cent sulphuric acid solution and transfer the filtrate to a 250 ml volumetric flask. Dilute to the mark and mix well.

Pipette (use Pipettor or other mechanical aid) 10 ml into another 250 ml volumetric flask and add, in order and with mixing after each addition, 10 ml of the 10 per cent citric acid solution, 2 ml iodine solution, 10 ml ammonium hydroxide (1:1) and 5 ml of the dimethylglyoxime solution. Dilute to the mark. Mix well and, after 5 min., read on the photometer, using a 525 mu filter. A nickel curve should be prepared before hand, made up by carrying various quantities of C.P. nickel through the above procedure.

TABLE I—RESULTS ON BUREAU OF STANDARDS SAMPLES

	Nickel Present	Nickel Found
B.S. 124a (Ounce metal)	.01	.01 .01 .01
B.S. 63a (80-10-10)	.32	.33 .32 .32
B.S. 62b (Manganese bronze)	.27	.27 .29 .27
B.S. 37c (Sheet brass)	.58	.58 .58 .57
B.S. 52a (Cast bronze)	.73	.72 .72 .74

Discussion—The method as given, covers the range 0.0-2.5 per cent nickel and a single sample requires 15-20 minutes for a nickel determination. The sample can be dissolved directly in sulphuric acid but spattering is apt to occur. If one wishes, zinc may be substituted for the aluminum, but in either case the strip should be checked to be certain it is nickel free. The citric acid solution prevents the precipitation of tin hydroxide as well as complexing iron aluminum, zinc manganese and any lead still in solution. The iodine solution was preferred to oxidize nickel to the quadrivalent state but many strong oxidizing agents have been used for this purpose—bromine water, sodium hypochlorite, potassium permanganate, etc.

The color of the nickelic dimethylglyoxime solution increases up to 10 minutes standing but if all samples are read at 5 minutes, results are comparable. Less than .01 copper was always found in the filtrate from the copper separation and that amount of copper is insufficient to effect the nickel result.[5] The method has been in use in this laboratory for more than six months and has been found satisfactory. Typical results of some runs on Bureau of Standards samples are shown in Table I.

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1. Grossman, H. and Mannheim, J., *Zeitschrift fuer Angewandte Chemie*, 30, 159 (1917.)
2. Weeldenburg, J. G., *Chemisch Weekblad* (Amsterdam) 21, 358 (1924).
3. Jones, B., *Analyst*, 54, 582 (1929).
4. Scott, W. W., *Standard Methods of Chemical Analysis*, 5th edition, p. 358, Vol. I, (1939).
5. Diehl, H., "Applications of the Dioximes to Analytical Chemistry," G. Frederick Smith Chemical Co., Columbus, O., p. 39, 1940.
6. Rollet, A. P., *Comptes Rendus*, 183, 212 (1926).

Revises Sale Terms For Castings

National Association of Purchasing Agents recently reapproved the Terms and Conditions of Sale compiled and published by the Gray Iron Founders' Society. Used by a large number of foundries for many years, the document consists of standard practices governing the sale of gray iron foundry industry products.

Members of the society's committee under whose jurisdiction the document was revised are: Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, O., chairman; J. W. Perry, Grede Foundries Inc., Milwaukee, and D. J. Vail, Campbell, Wayant & Cannon Foundry Co., Muskegon, Mich.

Copies of the document can be secured without cost from the society at 210 National City-East Sixth Building, Cleveland.

Book Review

The TVA Idea, by Dean Russell, paper, 108 pages, published by the Foundation for Economic Education, Irvington-on-Hudson, N. Y. Price 75 cents.

This book is devoted to a discussion of the consequences of expanding the TVA idea, and the need for attempting to reverse the trend which appears to be away from private ownership and operation of industry.

Brief Notes for Busy Foundrymen

THE BEGINNING AND THE END...

THE MULLER

Not enough can be said about mulling and aerating. In most foundries the muller will pay for itself by obtaining as near maximum green strength as possible. Aerating is important to the moulder, as it makes the sand more fluffy and easier rammed about the pattern. Many types of mullers, pug mills or paddle mixers are available, and each has advantages and disadvantages which can be clearly pointed out by companies handling such equipment. A unique method of rebonding foundry sands by first placing the bond in a water slurry and then adding to the mixer, pug mill or paddle mixer or muller that are directly on the sand floors, is rapidly gaining prominence and also saving money in the purchase of bonding agents. Write for Data 241, "Sperser Method of Rebonding Molding Sand."

THE SHAKE-OUT

It is wise to allow an apprentice or a new man in the foundry to observe the shake-out and point out its importance, as one standing at the shake-out can readily see if the sand is collapsing as it should and if the sand is burning-on to the castings. All gating arrangements can be clearly seen, many casting defects such as cold shuts and misruns can be observed, and pouring can be observed just as well at the shake-out as well as the pouring floors in determining excess metal loss or pouring short. Many other production operations can be noticed at the shake-out whereas they may be overlooked at the actual operations. A good sand man always visits the shake-out at least once each hour to observe the manner in which the castings are peeling and whether or not the sand is passing through the shake-out as it should.

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By ARTHUR H. ALLEN
Detroit Editor
THE FOUNDRY

AROUND Detroit

Cleveland apparently will be site of huge new Ford foundry and motor building plant. . . High-carbon iron still preferred for brake drums. . . Intricate castings in Chevrolet's transmission

FORD's new production gray iron foundry will be built at Cleveland, on a 200-acre site in Brookpark village, between Brookpark and Hummel roads and east beyond Engle road. The plant will have 17 acres of floor space, will employ better than 8000, and will include motor machining and assembly divisions. That is not official from the company, but all reports from Cleveland and trade sources here indicate the project is definite, to the point that village, county and state administrations have appropriated several hundred thousand dollars for relocation of roads, sewers and other improvements. This likely would not have been done unless the company had frozen its plans on where to build the projected engine unit (THE FOUNDRY, December, 1949, p. 158).

The foundry will be a whopper if present planning materializes, involving expenditure of something like $100 million. Melting equipment alone would comprise 25 to 30 cupolas, along with 10 or 15 large electric furnaces. Dock space has been acquired at Cleveland for in and out shipment of materials and finished engines, thus integrating the operation closely by water transport with the Rouge plant in Detroit and the new Buffalo pressed steel plant and final assembly, at least during the navigation season.

It should be emphasized the development is strictly of the long-term variety, probably requiring a minimum of two years for completion. But it will prove a bonanza for suppliers of foundry equipment, machine tools and the thousand and one items required by a new plant of this scope. Also involved is a major reshuffling of the present production foundry at the Rouge, which will take another substantial chunk of capital investment funds from the Ford coffers which have been spilling out $100 million yearly for branching Ford production out of the Detroit area. Capacity of the Rouge foundry will be trimmed around 30 per cent, permitting a more efficient layout. One of the first changes is to remove the crankshaft line to the so-called "new steel foundry" built during the war, which is on the Rouge property.

Several "planning teams" have been hard at work developing suggested layout for the complete new foundry and engine-manufacturing operations. They are working against each other and reportedly their members do not even speak to one another except in derogatory terms. When the various plans have been submitted to top manufacturing executives, a choice will be made and put into action. What happens to the losing teams no one seems to know.

It is possible that conventional foundry ideas are going to be tossed out the window as far as the Cleveland project is concerned. In the first place, some of the Ford manufacturing executives in the upper echelons, not in the least steeped in foundry tradition, make no bones about their unwillingness to accept the belief that it is necessary to install twice as many cupolas as are being operated at any one time, in order that the "down" units can be relined. They say that just doesn't make sense. Maybe it would be O.K. to have one cupola out of, say, 12 down for repairs, as in the case of open-hearth furnaces, but to have half of such expensive melting equipment idle—never. They don't care what the traditional way of operating cupolas is, that's a thing of the past as they figure.

So engineers are studying ways and means of operating a cupola continuously for perhaps a week at a time before refractory repairs would be needed. At the Ford plant in Dagenham, England, there is a small cupola designed with a tapering bottom section of "corrugated" cast steel, water cooled and packed with refractory mud in the depressions of the corrugations before it is lighted. It is said to require repacking only after a considerable period of melting.

If some idea such as this could be translated to the large-size cupolas used in a production gray iron foundry, the resulting savings would be appreciable. A Ford metallurgist is understood to be about ready to take off for a first-hand inspection of the Dagenham equipment, perhaps bringing back some ideas as to how to do the job successfully here. Cupola metal will be duplexed in electric furnaces, which will also come in handy should there be some major developments in the field of nodular iron for automotive applications.

Two new engines slated for eventual use in Ford passenger cars are a 6-cylinder and V-8 of the overhead-valve high-compression type, and castings for them will be a principal assignment of the new Cleveland foundry when it goes into operation. They will be entirely different from present engines built by Ford and will involve new patterns, tools and the like. Thus the present L-head six and V-8 appear destined for eventual discontinuance.

There are a number of other hot new engine projects which will mean good business for suppliers of foundry equipment and machine tools. All are of course in the direction of overhead valves and high compression, necessitating a beefing-up of castings sections. Studebaker is close to releasing tooling for such an engine, and Chrysler already has placed orders for initial machine tools needed for a new power plant to be introduced eventually in the Chrysler division models.

* * *

ONE of the many technical highlights of the annual Society of Automotive Engineers convention in Detroit last month was a comprehensive analysis of brake drum materials by Fred J. Walls of the Detroit Technical Section, International Nickel Co. Inc. Carefully reviewing all the technical and patent literature on the subject, Mr. Walls summarized the findings of other investigators and concluded that, for the present at least, high total carbon cast irons fulfill requirements of the braking surface to a greater extent than any known alloy. Engineers continue the search for something better, and brake specialists are demanding im-

(*Concluded on page* 174)

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(*Concluded from page* 172)

proved materials, but their demands thus far are unsatisfied.

In the present state of the art, brake drums are a compromise, although manufacturers might select a specified cast iron and design within relatively small factors of safety if they could be certain that the brakes on an individual vehicle would be operated under predetermined limited conditions. This, Mr. Walls pointed out, can never be accomplished because of four uncontrollable variables in environment—operators, traffic, topography and atmosphere.

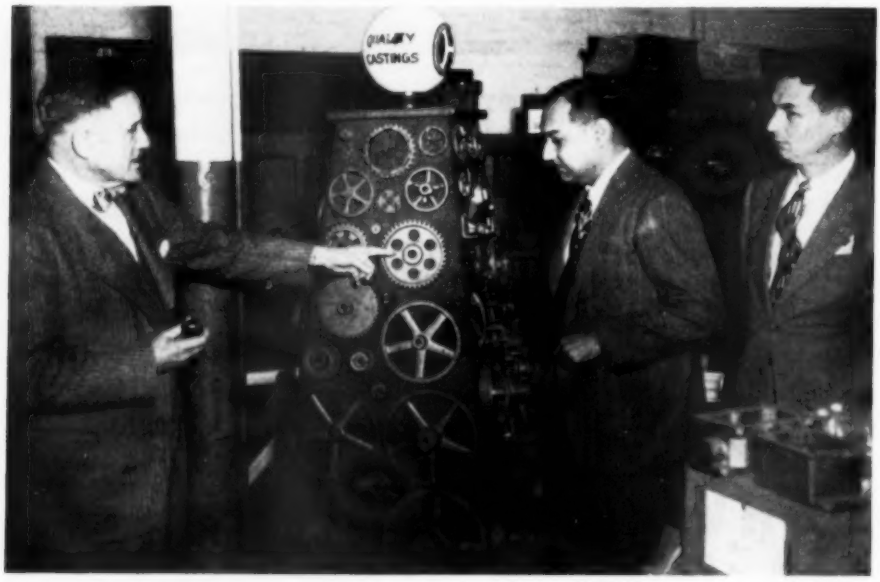
Life expectancy of a brake drum can be summed up by its resistance to thermal fatigue, wear and galling or scoring, and mechanical breakage. Thermal fatigue is a function of design, expansion, conductivity, rate of heat input and the number of cyclic heatings. Wear and galling are functions of structure, hardness and fusion point. Mechanical breakage is a function of strength and design.

* * *

CONSIDERABLE interest is being shown around the country in the prototype model of a small 84-inch wheelbase two-passenger 1400-pound passenger car which Nash is wondering whether it might build profitably. Power would be supplied by either 18 or 36-horsepower 4-cylinder engines produced by Fiat in Italy or Standard in England. Price would be $1000 or under. Nash is sampling the opinions of 250,000 persons to see if they would be interested buyers of such a vehicle as a second car, or a new car for those on limited budgets. It could not be in production inside of a year, and at the showing held in Detroit, where 600 or more suppliers, manufacturers and competitors swarmed in to inspect the model, reaction was none too enthusiastic.

Some well designed high-quality gray iron castings are integral parts of Chevrolet's new automatic transmission, including case, housing, servo cover, valve body, oil pump housings and reverse and low drums. They are blueprinted for the best possible foundry conditions, easy cleaning and machining, and the best possible oil sealing. Particularly interesting is the intricately cored and relatively thin-walled valve-body casting which, in other transmissions of this type, has been made as an aluminum die casting. The hydraulic system must carry pressures up to 180 psi without leaks, so sound castings are essential.

Gerlinger Equipment Inc., Milwaukee, has opened a branch office at 38 S. Dearborn St., Chicago. Don Gerlinger, vice president of Gerlinger Equipment Company, will be in charge of the Chicago office which will handle the sale and service of molding machines, core blowers, sand mullers, sandslingers, core ovens and miscellaneous foundry equipment.



INDIAN VISITOR: R. M. Desai, Bombay, India, representing the Indian government, is in this country studying the machine tool industry and recently spent two weeks at Hamilton Foundry & Machine Co., Hamilton, O., observing production of machine tool castings. Mr. Desai is one of a hundred Indian engineers studying various phases of American industry. Shown above, left to right, are: Donald McDaniel, vice president, Hamilton Foundry; Mr. Desai, and C. C. Fracker, executive assistant to the president, Hamilton Foundry

Book Review

Precis d'Analyse Chimique des Aciers et des Fontes (Manual of Chemical Analysis of Iron and Steel) by M. Jean, cloth, 542 pages 6¼ x 9⅜ in., published by Dunod, Paris, France. Price 3360 francs.

This book, published in French under the auspices of the Institute for Research on Iron Metallurgy and the Center of Iron Metallurgy Documentation, is a compendium of standard methods of analysis of iron and steel. It includes practically all of the methods of analysis in vogue for routine as well as the more accurate or umpire procedures with details on manipulation, reactions involved, etc.

Containing 22 chapters, the book describes analytical methods for determination of carbon, silicon, manganese, sulphur, phosphorus, copper, nickel, chromium, molybdenum, tungsten, cobalt, arsenic, titanium, vanadium and aluminum. Procedures for nitrogen, tin, lead, beryllium, zirconium, tantalum and niobium, and boron also are given.

Issues Training Film Bibliography

"Industrial Film Bibliography," published by the National Metal Trades Association and listing 1400 motion picture and slide film training aids, has been distributed to 2000 member concerns. The films are useful as aids for supervisory and employee training programs.

Each film is described as to contents, running time, availability and whether black-and-white or color, sound or silent. Several sources from which each film may be bought, rented or borrowed, as well as the sales or rental price charged, if any, are given.

Specifications for Electroplating

Sponsored jointly by the American Society for Testing Materials and the American Electroplaters' Society, the 1949 edition of *Specifications and Tests for Electrodeposited Metallic Coatings* now is available from ASTM for $1.25. Containing 62 pages, the publication brings together in convenient form all of the standard specifications and test methods pertaining to electrodeposited coatings on steel, copper and copper-base alloys, and zinc and zinc-base alloys. Copies may be secured from the American Society for Testing Materials, 1916 Race St., Philadelphia 3.

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TIME is the most valuable commodity we have. Save time in producing cores, and you save all along the line. Fuel, floor space, customer good will—these are a few items of saving or gain that result from the use of the faster drying, lower temperature baking characteristics of Delco 30 Series Core Oil.

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Representative foundries report as follows—

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- "Results indicated 30 Series Delco Core Oil best suited our general overall work."
- "Best Core Oil I ever used!"
- "We are using one-fifth less oil, and the baking time in the ovens has been reduced approximately two hours."

Results like these appeal to every profit-minded foundryman. You can get similar results in your plant. Let our Cities Service representative aid you in applying the correct grade of Delco Core Oil for your specific requirements. This service is prompt, reliable, valuable—and *free*. Cities Service Oil Company, Chicago, Cleveland, Kansas City, St. Paul and Toronto; Arkansas Fuel Oil Company, Shreveport.

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ACTIVITIES OF FOUNDRY Groups

Canton

DECEMBER meeting of the Canton District Chapter of the AFS featured a talk entitled "History and Engineering of Railroad Car Couplers," by F. H. Kayler, American Steel Foundries, Alliance, O. Introduced by Thomas W. Harvey, Pitcairn Co., Barberton, O., Mr. Kayler asserted, "The automatic railway car coupler is so strictly a casting job that no one has ever attempted to produce it as a fabricated job. Even the early designs were made as malleable castings."

The speaker also pointed out that every car in the United States and Canada must be capable of coupling with every other car on standard gage roads, which means that couplers on any car must be capable of coupling with any one of approximately 4 million other couplers. Mr. Kayler then explained the procedure in adopting and maintaining standards for the couplers. Mr. Kayler showed movies of tests conducted by American Steel Foundries which illustrated how the patented special type railway car trucks produced by that company were superior to coiled spring trucks.

Another film, entitled "A Letter from America," presented through the courtesy of the Goodyear Tire & Rubber Co., Akron, O., depicted the reminiscenses of an immigrant boy who made good in this country through free enterprise.—*Alexander Prentice, Stark Foundry Co.*

Eastern Canada

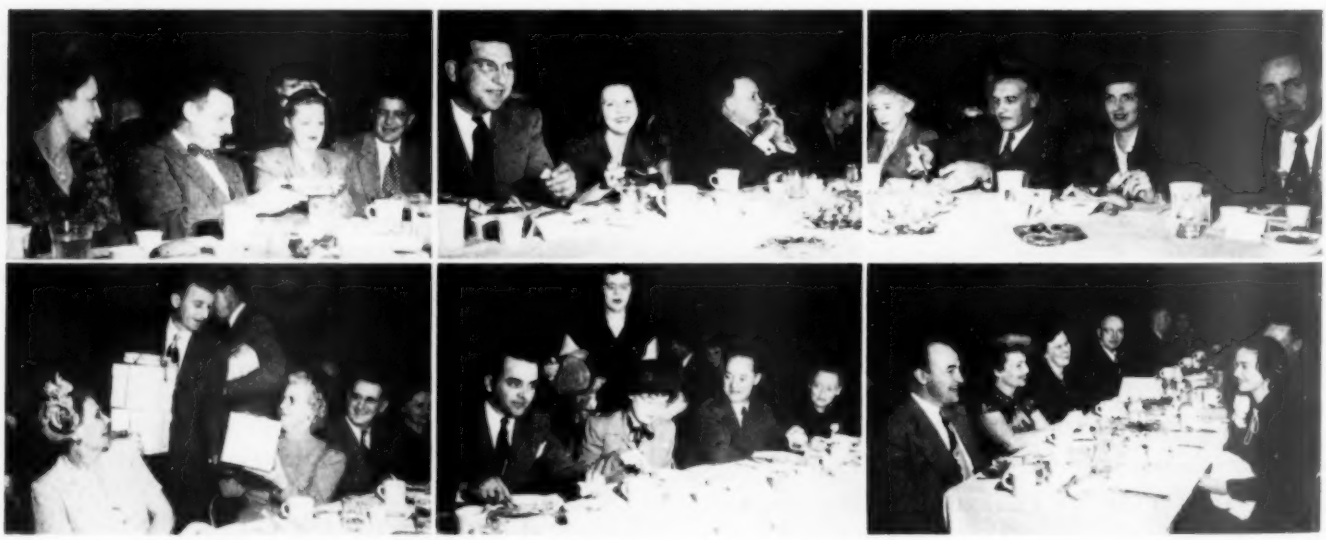
PATTERN engineering and foundry practice was discussed by Alexander Pirrie, Gurney Foundry Co. Ltd., Toronto, Ont., at the Dec. 9 meeting of Eastern Canada Chapter of the AFS held at the Mount Royal Hotel, Montreal, Que. A. J. Moore, Montreal Bronze Ltd., served as technical chairman. In his discussion, which was illustrated by slides, Mr. Pirrie pointed out the advantages of a thorough understanding between the design engineer, patternmaker and foundry superintendent in preparing drawings and patterns, and developing production methods. — *A. J. Moore, Montreal Bronze Ltd.*

Washington

IN this age of modern production, success depends on working through others, stated Ralph L. Lee, public relations department, General Motors Corp., Detroit, at the Nov. 18 meeting of Washington Chapter of the AFS held at the Gowman Hotel, Seattle.

Mr. Lee continued, in his talk "Man to Man on the Job," that standardization and precise measurements—facts, in other words—have made modern technological progress possible, but in the human relationship of production, we must work through human beings who are all different. We need facts about people. Mr. Lee believes we need an instrument

(*Continued on page* 178)



CENTRAL ILLINOIS Chapter of the AFS held its fourth annual Christmas party Dec. 10 at Peoria, Ill. Shown at the party, left to right, across top are: Mrs. and Mr. Bert Bevis and Mrs. and Mr. John Nieman; Mr. and Mrs. Charles Bucklar and Mr. and Mrs. R. H. Swartz; Mrs. and Mr. L. D. Harkrider, and Mrs. and Mr. C. W. Russell. Left to right across the bottom are: W. Debbout presenting gifts to the ladies; Mr. and Mrs. Robert Dickison; Mr. and Mrs. Joe McLean; Mr. and Mrs. George Martin; Mrs. and Mr. C. E. Robinson and on extreme right Mrs. and Mr. Richard Aylward. Photos courtesy of Caterpillar Tractor Co.

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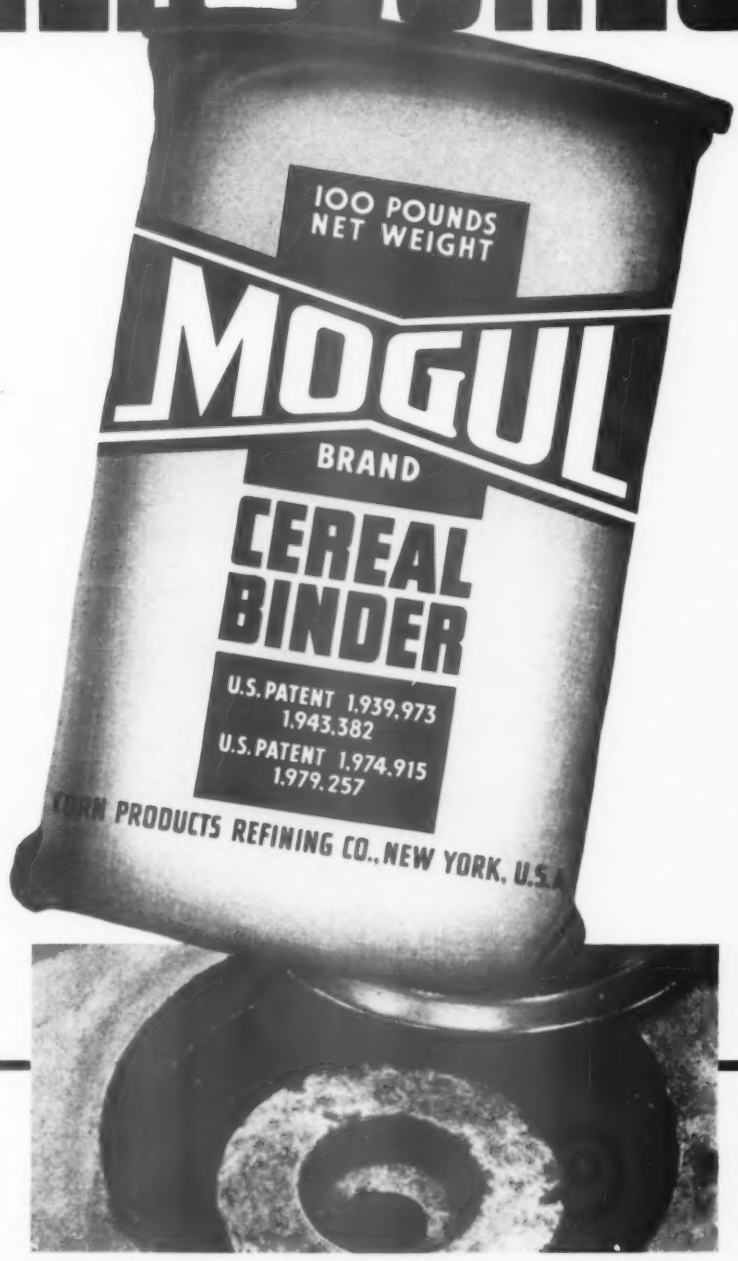

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NORTHWESTERN PENNSYLVANIA Chapter of the AFS held its Christmas party at the Saga Club, Erie, Pa., Dec. 16. Shown above is Frank P. Volgstadt, Griswold Mfg. Co., Erie, chapter vice chairman, presenting past chairman buttons to Joseph Hornstein, Meadville Malleable Iron Co., Meadville, Pa.; John Clarke, General Electric Co., Erie, and Earl M. Strick and Roger Griswold, Erie Malleable Iron Co., Erie. Joseph A. Shuffstall, National-Erie Corp., Erie, chapter chairman, is shown seated, facing the camera

(*Continued from page* 176)

to gage the human element, a "humanometer." The man who successfully directs people's efforts in the production team must have the qualities of a human catalyst. He must use them as they are in all their divergent characters, understanding them as they are, learning their past and helping them to change for the better, directing that change in the individual for the good of employer and employee. Just as metals can be made useful for various purposes by alloying treatment, so can this human "alloying" treatment bring human beings to their best degree of usefulness.

Prof. Gilbert Schaller, University of Washington, Seattle, was appointed a director of the chapter to serve for three years. Robert Gregg, Reliance Regulator Co., Alhambra, Calif., a director of the AFS, gave a brief coffee talk in which he stated that the national directors of the society have been designated as contact men for chapters in their areas so the society can better meet the needs of its chapters.—*Harold R. Wolfer, Puget Sound Naval Shipyard.*

Northwestern Pennsylvania

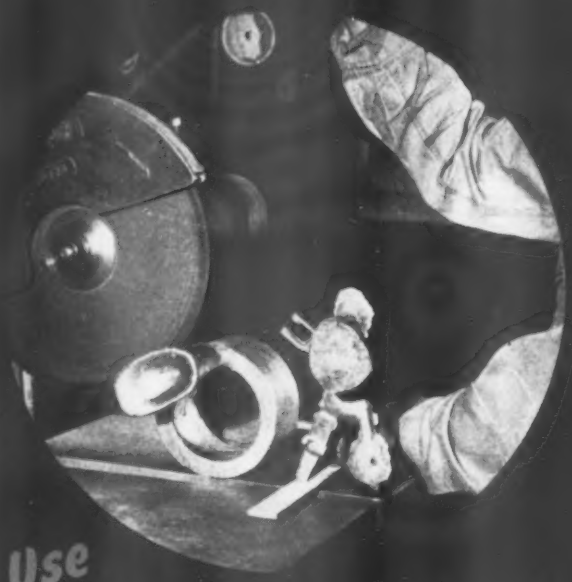
TWO hundred and twenty-five members and guests of Northwestern Pennsylvania Chapter of the AFS attended the largest Christmas party in the chapter's history at the Saga Club, Erie, Pa., on Dec. 16.

After a delicious dinner, Chairman Joseph A. Shuffstall, National-Erie Corp., Erie, introduced several guests and also congratulated the committee for its work in arranging the party.

(*Continued on page* 180)

WISCONSIN Chapter of the AFS held its annual Christmas party Dec. 9 at Schroeder Hotel, Milwaukee. Photos of the party are by courtesy of Walter Napp, Badger Firebrick & Supply Co.

2 Good Ways to Reduce Non-ferrous Cleaning Room Costs!



Use **NORFLEX WHEELS** for Removing Gates and Risers

(1) Sturdy, yet flexible NORFLEX Wheels are reducing non-ferrous cut-off costs everywhere because they're strong and safe and will withstand considerable sidegrinding, twisting and bending.

(2) Although great strength and flexibility are outstanding features of NORFLEX Wheels, they cut fast, often faster than conventional cut-off wheels.

(3) Because NORFLEX Wheels often last four to six times longer than conventional wheels—with practically no danger of breakage—fewer wheel changes are necessary, and a substantial saving in labor cost, grinding wheel expense and grinding time is possible.

and **CRYSTOLON WHEELS** for Removing Excess Metal

CRYSTOLON Wheels, especially designed for grinding non-ferrous castings, feature a fast, smooth cutting action insured by strong, sharp CRYSTOLON abrasive and filler treatments which prevent wheel loading.

Their extra long life is insured by special B-5 and B-7 resinoid bonds for high speed wheels and by vitrified bond for slow speed wheels. They are available in a variety of sizes and shapes to fit all standard bench, floor stand and portable grinders.

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EASTERN NEW YORK Chapter of the AFS held its Christmas party Dec. 20 at Circle Inn, Lathams, N. Y. Jasper N. Wheeler, Wheeler Bros. Brass Foundries Inc., Troy, N. Y., and chapter vice chairman, was in charge of the program

(*Continued from page* 178)
Committee members were Charles F. Gottschalk and Courtney Wilcox, Cascade Foundry Co., and Dewey Davis, Urick Foundry Co. Frank P. Volgstadt, vice chairman of the chapter, presented Roger Griswold, Earl Strick, John Clarke and Joseph Hornstein with past chairman buttons. An outstanding floor show of four acts topped off the evening's entertainment.—*Earl M. Strick, Erie Malleable Iron Co.*

Connecticut Non-Ferrous

AIR tools and the air power story was presented by John G. Lutz, Ingersoll-Rand Co., New York, at the Nov. 16 meeting of the Connecticut Non-Ferrous Foundrymen's Association held at Castle Restaurant, New Haven, Conn.

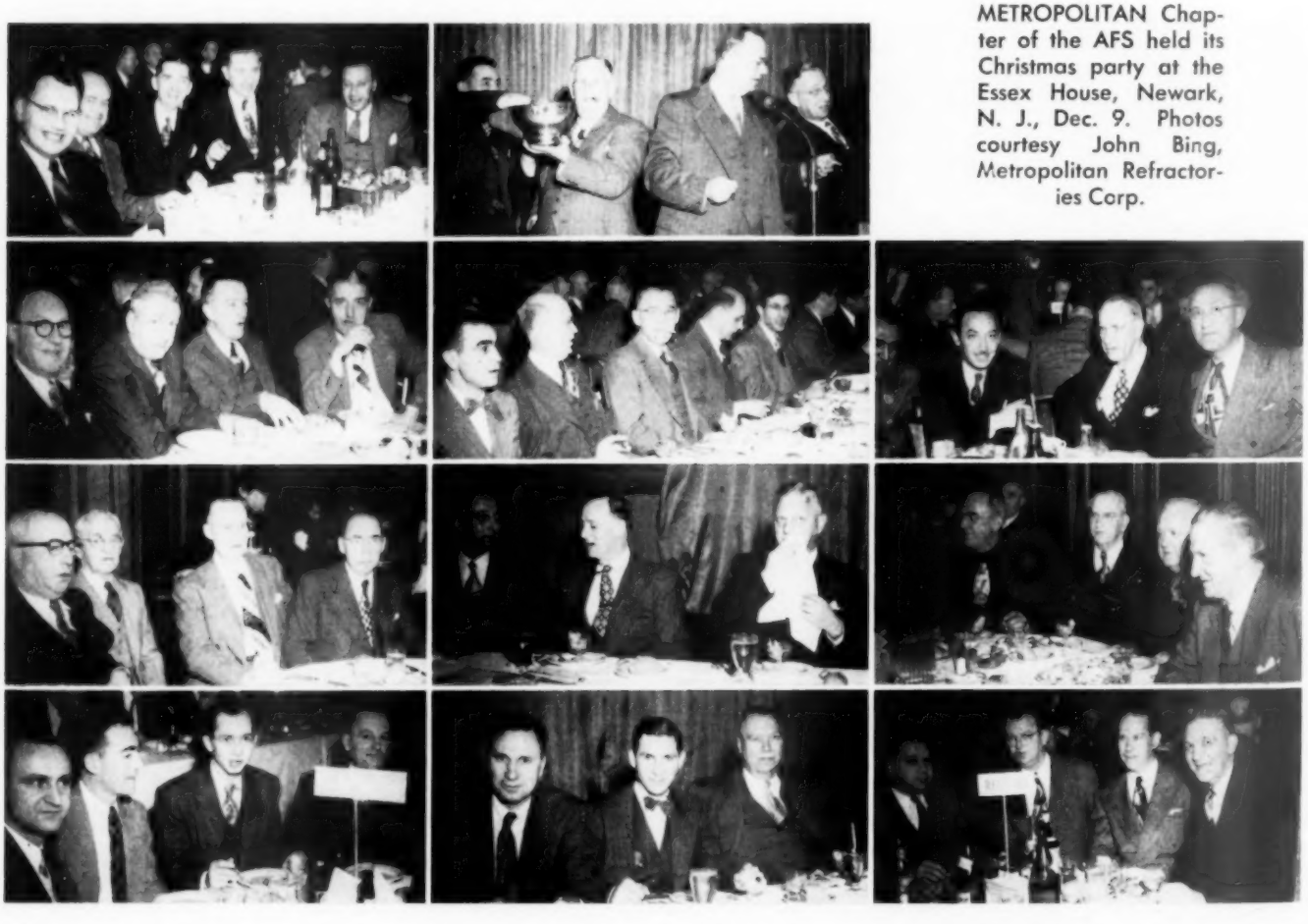
The speaker prefaced his remarks by stating that tools increase the worker's ability to accomplish useful work and air tools are important factors in this regard. Examples, were cited, and Mr. Lutz stressed the need for ample compressor capacity to insure greatest efficiency from air tools. Raising air pressures from 70 to 90 pounds resulted in an increase of 36 per cent efficiency, according to a handbook prepared by the Compressed Air & Gas Institute.—*Charles A. H. Knapp, R. Lavin & Sons Inc.*

Wisconsin

AT a dinner sponsored Dec. 8 by the Wisconsin Manufacturers' Association and the Department of Mining & Metallurgical Engineering, University of Wisconsin, Madison, 120 members of the foundry industry from the state were present to visit the department's laboratories, meet the staff and become acquainted with 17 Foundry Educational Foundation scholarship students enrolled at the school.

Following dinner the film, "This Moving World," produced by the Malleable Founders' Society, was shown. F. D. Harkrider, president, General Aluminum & Gray Iron Division of General Malleable Corp., Waukesha, Wis., opened the meeting and Prof. George Barker, head of the university's mining and metallurgy depart-

(*Continued on page* 182)



METROPOLITAN Chapter of the AFS held its Christmas party at the Essex House, Newark, N. J., Dec. 9. Photos courtesy John Bing, Metropolitan Refractories Corp.

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to gas regulating problems

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Everyone concerned with regulating gases under pressure will find use for this helpful catalog. It will save him time, effort and needless waste of money. It contains data regarding the proper regulator for any given type of job.

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NORTHEASTERN OHIO Chapter of the AFS met at Tudor Arms Hotel, Cleveland, Nov. 10. Principal speaker at the meeting was Richard G. McElwee, Vanadium Corp. of America, Detroit, shown at right above. At the left is Fred J. Pfarr, Lake City Malleable Co., Cleveland, chapter vice president. Photo is by courtesy of Sterling N. Farmer, Sand Products Corp.

(*Continued from page* 180)

ment, took the opportunity to thank the Wisconsin Chapter of the AFS for the sand muller which had been presented to the department several months before.

Christmas party held by Wisconsin Chapter of the AFS on Dec. 9 at Hotel Schroeder, Milwaukee, was enjoyed by nearly 600 members and guests. Several of the members displayed their skill at the piano, livening up the affair before the stage show was put on.

Robert Woodward, chapter president, discussed plans for the regional conference to be held Feb. 9 and 10, and said if everyone present would attend and bring along a friend in the foundry business, it would be one of the best attended conferences held by the chapter.—*John E. Hubel*

Quad City

CHRISTMAS party of Quad-City Chapter of the AFS, held at the Blackhawk Hotel, Davenport, Iowa, was a big success and 307 members and guests were present to enjoy the festivities. Refreshments were served followed by dinner and entertainment. A. H. Putnam was responsible for the entertainment and A. D. Matheson, William McFatridge and J. H. Nelsen carried the detail work of the party through with precision.—*R. E. Miller, John Deere Planter Works.*

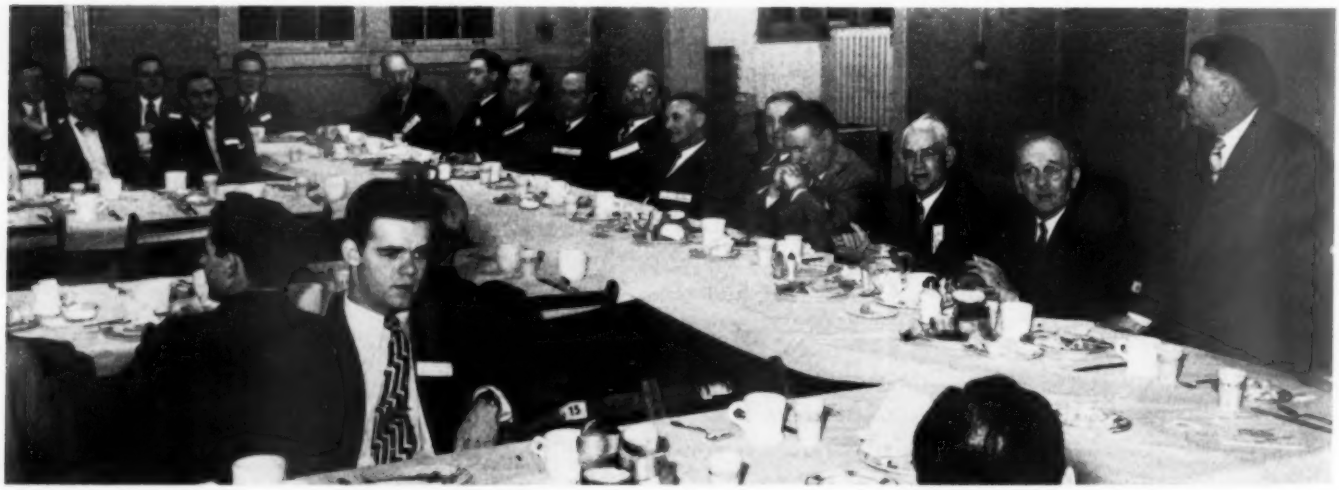
Ontario

FOURTH meeting of the current season for Ontario Chapter of the AFS was held at Windsor on Dec. 2. Morning and afternoon that day were spent in visiting the following plants: Michigan Steel Casting Co., Sherwood Brass Works and City Pattern Works of Detroit, and the Auto Specialties Mfg. Co. Ltd., Bryant Pattern & Mfg. Co. Ltd., Walker Metal Products, Ford Motor Co. foundry and the block machine shop of the Chrysler Motor Co., in Windsor.

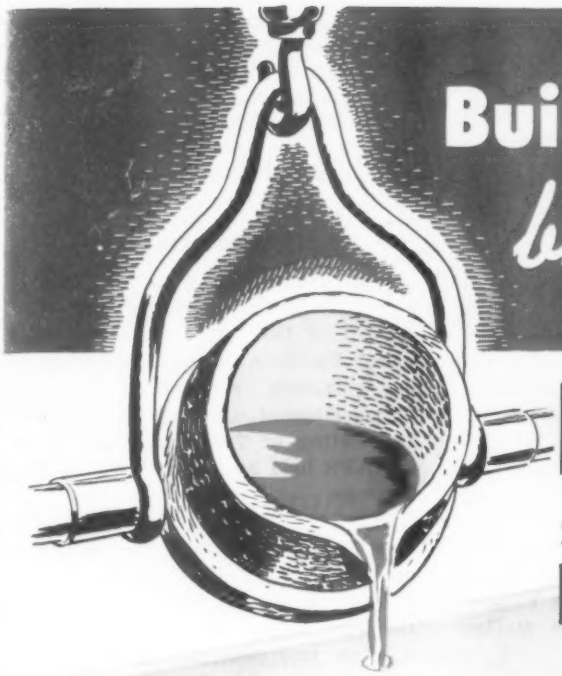
After the dinner held at the Prince Edward Hotel, Windsor, at which about 200 were present, two group meetings were held. The nonferrous group, with Harold Gray, Wallaceburg Brass Co. Ltd., as chairman, heard Harold Younger, Chicago Faucet Co., describe operations at the Chicago plant.

The ferrous session featured a talk on "Nodular Iron Development" by Robert B. Melmoth, Manufacturing Research Division, Ford Motor Co., Dearborn, Mich., with Harold Gregory, Walker Metal Products Ltd., as chairman. Mr. Melmoth has had con-

(*Continued on page* 184)



WISCONSIN: Scene at dinner sponsored by the Wisconsin Manufacturers' Association and the Mining & Metallurgical Department of the University of Wisconsin at the university, Dec. 8. Shown at the speakers' table, left to right are: Prof. Kurt F. Wendt, University of Wisconsin; Robert Hueschen, president, University of Wisconsin Mining & Metallurgical club; George K. Dreher, Foundry Educational Foundation; Walter Edens, Wisconsin Chapter secretary; Dean M. O. Withey, University of Wisconsin; L. D. Harkrider, president, Wisconsin Manufacturers' Association; James Lansing, Malleable Founders' Society; George E. Tisdale, Wisconsin Chapter treasurer; R. C. Woodward, Wisconsin Chapter president, and Profs. E. R. Shorey and George J. Barker, University of Wisconsin



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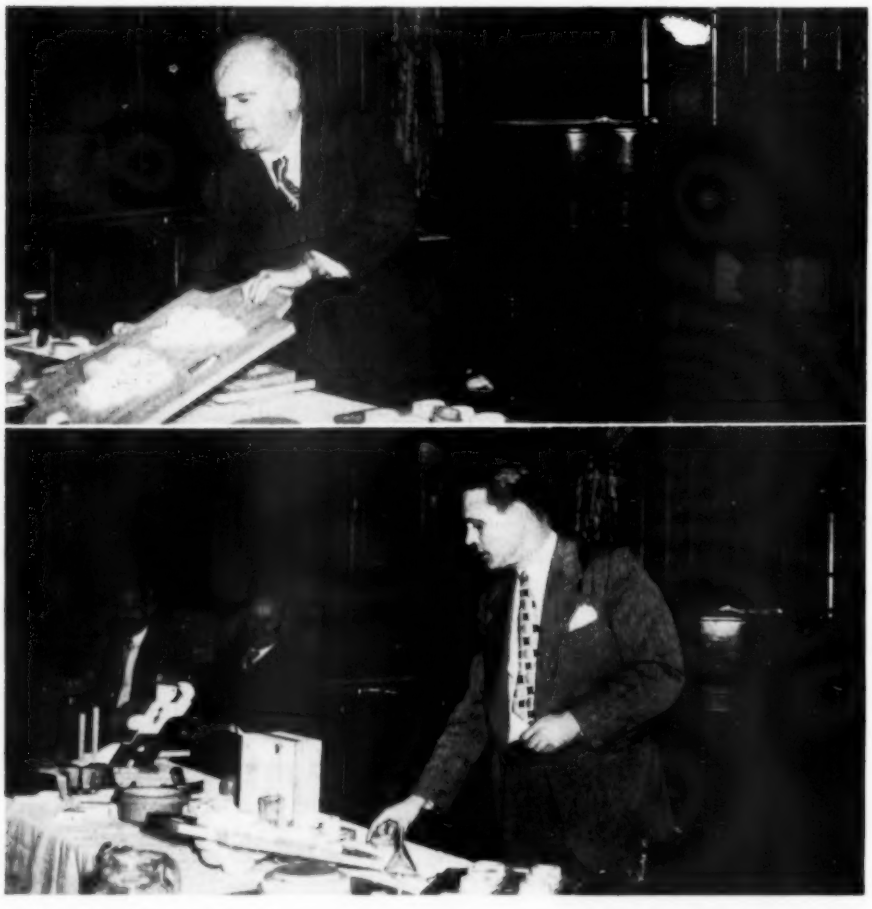
TENNESSEE Chapter of the AFS heard A. Lesley Gardner, Pangborn Corp., Hagerstown, Md., speak on "A Mechanized Cleaning Department Makes Money," at its November meeting. Shown at the meeting, front row, left to right, are: Porter Warner Jr., Porter Warner Industries, Chattanooga, Tenn., and Mr. Gardner. Top row, left to right, are: E. C. Gilmour, Pangborn Corp.; Merritt Van Valkenburgh, M. H. Rhodes Inc., Hartford, Conn.; and Fred H. McGee, Fred H. McGee Co., Chattanooga

(*Continued from page* 182)
siderable research experience on nodular iron and gave a complete history of his organization's development to date.

Guests introduced at the dinner included C. S. Parsons, chief, Bureau of Mines, Department of Mines and Resources, Ottawa, Canada; R. J. Wilcox, Michigan Steel Castings Co., Detroit, and chairman of the Detroit Chapter of the AFS; Jess Toth, Harry W. Dietert Co., Detroit, and Detroit Chapter vice chairman; and Fred J. Walls, International Nickel Co. Detroit, a past president of the AFS. —*C. H. Johnston, E. Long Ltd.*



EASTERN NEW YORK Chapter of the AFS met at Circle Inn, Lathams, N. Y., Nov. 15. In top view is Franz Schumacker, chief patternmaker, Cooper Alloy Foundry Co., Hillside, N. J., principal speaker. Lower photo shows K. F. Echard, Eddy Valve Co., Waterford, N. Y., chapter chairman

Tennessee

A MECHANIZED Cleaning Department Makes Money," was the subject of the talk presented by A. Lesley Gardner, advertising and public relations manager, Pangborn Corp., Hagerstown, Md., at the Nov. 18 meeting of Tennessee Chapter of the AFS held at Hotel Patten, Chattanooga.

Mr. Gardner pointed out that early blast cleaning machines used sand and air. Finally the use of shot and grit was discovered and the invention of the centrifugal wheel led to many modern improvements now in use. With sketches Mr. Gardner illustrated the advancement of blast cleaning machines. The drawings also showed principles of operation of modern cleaning machines.

Mr. Gardner presented a 20-minute sound film showing cleaning equipment in the Ford Motor Co. E. C. Gilmour, St. Louis district manager of the Pangborn Corp., was present and participated in the discussion period.

Karl Landgrebe, Wheland Co., Chattanooga, and chairman of the chapter, presided. Fifty members and guests were present.—*Carl A. Fischer Jr., Fischer Supply Co.*

Northern California

DECEMBER meeting of Northern California Chapter of the AFS was held at Pland's Restaurant, Oakland, Calif., on Dec. 9. Donald C. Caudron, foundry superintendent, Pacific Brass Foundry of San Francisco, was the speaker, and he gave the paper which he had presented at the American Foundrymen's Society convention in St. Louis. It was entitled "The Gas-Fired Melting of Copper Base Alloys under Reducing Atmospheres." — *Milton Oakes, American Manganese Steel Division.*

Chesapeake

NOVEMBER meeting of Chesapeake Chapter of the AFS included an afternoon tour of the Baltimore plant, American Radiator & Standard Sanitary Corp. About 30 members saw the fast-moving molding, pouring, shakeout line and were also interested in the process by

(*Continued on page* 186)

THEY THOUGHT IT COULDN'T BE DONE

but Lectromelt doubled electric furnace production by doing it!

Other electric furnace designers said it couldn't be done. But Moore, inventor of the Rapid Lectromelt Furnace, dared to boost the power fed to arcs. Production zoomed as power input was pushed up. The day's work was doubled.

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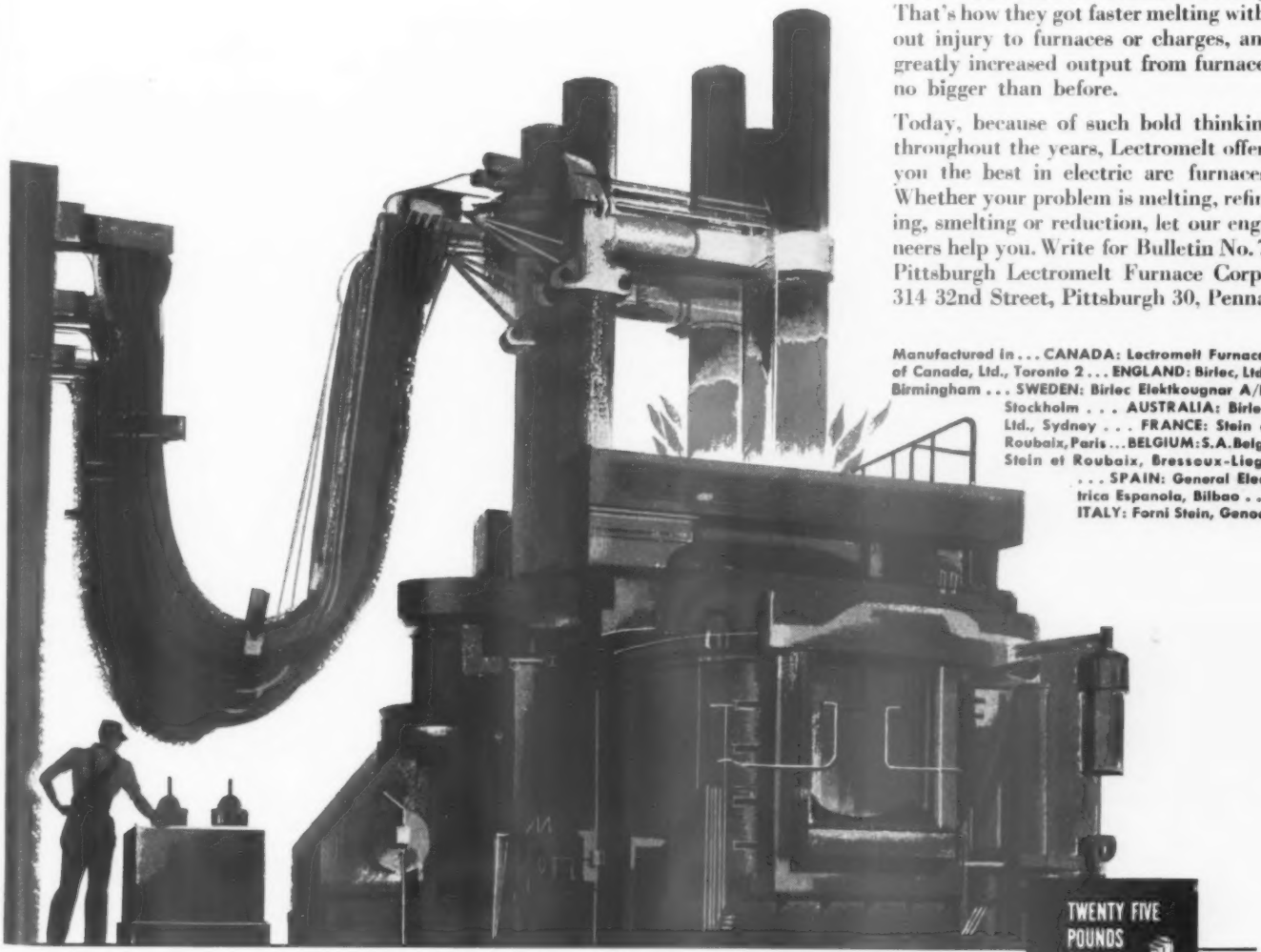
Today, because of such bold thinking throughout the years, Lectromelt offers you the best in electric arc furnaces. Whether your problem is melting, refining, smelting or reduction, let our engineers help you. Write for Bulletin No. 7, Pittsburgh Lectromelt Furnace Corp., 314 32nd Street, Pittsburgh 30, Penna.



Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham . . . SWEDEN: Birlec Elektkougnar A/B, Stockholm . . . AUSTRALIA: Birlec, Ltd., Sydney . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S.A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa.

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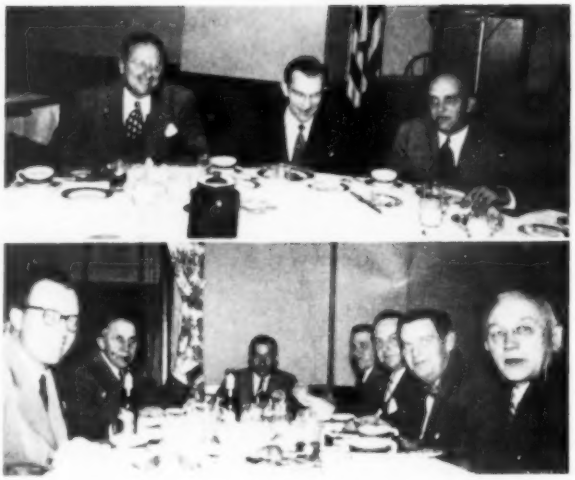
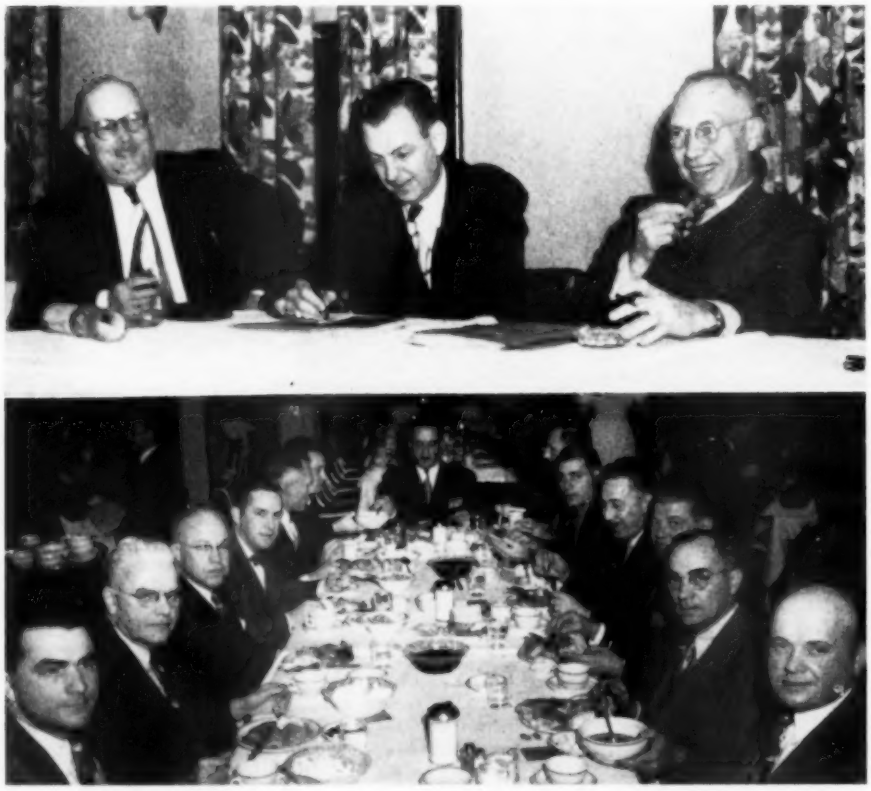


CHESAPEAKE Chapter of the AFS featured showing of the film "Fluid Flow in Transparent Molds" at its November meeting. The narrator was Dr. R. F. Thompson, International Nickel Co., New York. In top view, left to right, are: A. A. Hochrein, Federated Metal Division, American Smelting & Refining Co., Baltimore; Dr. Thompson; and J. B. Mentzer, Wood Embly Brass Co., Waynesboro, Pa. Lower view shows guests at one of the dinner tables

(*Continued from page* 184)

which the sanitary ware receives its glazed-enamel finish.

After dinner at the Engineers Club, more than 60 members and guests saw the AFS-sponsored research film "Fluid Flow in Transparent Molds." The film was introduced and narrated by Dr. R. F. Thompson, International Nickel Co. From this study it was concluded that aspiration of mold gases and air into flowing molten metal could be reduced by maintaining a deep head of metal in the pouring cup, by tapering the down sprue, and by rounding all the corners in the gating system to assure streamlined flow. The fluid flow principles demonstrated by this high-speed photography give foundrymen a good insight to solution of many gating problems.—*Jack H. Schaum, National Bureau of Standards and George L. Webster, Baltimore Polytechnic Institute.*



SAGINAW VALLEY Chapter of the AFS met Dec. 1 at the Fischer Hotel, Frankenmuth, Mich., to participate in panel discussions on "Metal Control." Panel speakers shown at top, left to right, are: Roy Foster, Bay City Foundry Co., Bay City, Mich.; Arthur Karpicke, Central Foundry Division, General Motors Corp., Saginaw, Mich., and Manley E. Brooks, Dow Chemical Co., Bay City. Lower photo is a view of guests at one of the dinner tables

Saginaw Valley

A PANEL discussion on "Metal Control" was the main feature of the Dec. 1 meeting of Saginaw Valley Chapter of the AFS held at Fischer Hotel, Frankenmuth, Mich. The 150 members and guests present also enjoyed a special attraction, a sound film describing use of chaplets, which was presented through the courtesy of the Fanner Mfg. Co., Cleveland, O.

The panel discussion, with Walter F. Bohm, foundry metallurgist, Buick Motor Division, Flint, Mich., as technical chairman, was divided into three sections with gray iron metal control being discussed by Roy Foster, Bay City Foundry Co., Bay City, Mich.; malleable iron control by Arthur Karpicke, Central Foundry Div., General Motors Corp., Saginaw, Mich.; light metals control by M. E. Brooks of the Dow Chemical Co., Bay City, Mich. Each of the speakers stressed the importance of the melting unit and melting practice. In addition, many simple tests which can be set up to control the quality of molten metal were pointed out.—*Kenneth H. Priestley, Vassar Electroloy Products Inc.*

Cleveland Non-Ferrous

FORTY members of the Cleveland Chapter, Non-Ferrous Founders' Society attended the annual Christmas party held at the Athletic Club, Cleveland, Dec. 22. Dr. R. T. Maneely, Hoffman Bronze & Aluminum Casting Co., Cleveland, who is chairman of the chapter, presided. Special entertainment was provided.

Michiana

REGULAR meeting of Michiana Chapter of the AFS was held at Hotel LaSalle, South Bend, Ind., on Dec. 5. William F. Lange Jr., Casting Service Corp., LaPorte, Ind., introduced Ralph L. Lee, General Motors Corp., Detroit, the speaker. Mr. Lee demonstrated the unique ability of combining sincerity and humor in his talk.

Two films released by the Fanner Mfg. Co., Cleveland, were presented at the Jan. 3 meeting of Michiana Chapter of the AFS held at the LaSalle Hotel, South Bend, Ind. Use of chaplets and chills in modern foundry practice by a number of leading foundries was illustrated.

Chapter's February meeting will be held at the LaSalle Hotel, South

(*Continued on page* 188)

You can gain Both -- the answer is Famous CORNELL CUPOLA FLUX

HUNDREDS of leading foundries have fallen in line with regular users of Famous Cornell Cupola Flux. *By improving their castings, they avoid many rejects and make better deliveries.*

Famous Cornell Cupola Flux purifies molten metal, makes it more fluid and reduces sulphur.

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EASIEST FLUX TO USE. You simply lift it out of container and toss it into cupola with each ton charge of iron or break off one to three briquettes (quarter sections) for smaller charges, as per instructions.

WRITE FOR BULLETIN NO. 46-B

MALLEABLE FOUNDRIES, with cupola operation, are showing a rapid trend towards the use of Famous Cornell Cupola Flux. Reports of greatly improved casting production come from every direction. Furthermore, there is a considerable reduction in cupola maintenance labor and cost. The life of cupola lining, whether brick or stone, is greatly prolonged.

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Famous CORNELL ALUMINUM FLUX

CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive Formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

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Famous CORNELL BRASS FLUX

CLEANSES MOLTEN BRASS even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

(*Continued from page* 186)

Bend, on Feb. 7. Guest speaker for the meeting will be Vaughn C. Reid, City Pattern Foundry & Machine Co., Detroit. His subject will be "Materials Used in the Construction of Production Pattern Equipment."—*J. P. Jordan, Dodge Mfg. Corp.*

Twin City

ANNUAL joint meeting of Twin City Chapter of the AFS and the Northwest Chapter of the ASM was held at the Covered Wagon, Minneapolis, Nov. 17. A. T. Ridinger, chairman of the ASM chapter, introduced J. C. Neemes Jr., local technical representative of the International Nickel Co., who discussed "Ductile Cast Iron." Nearly 200 members and guests were present.

The speaker defined ductile iron and clarified the terminology in use today, going on to explain how spheroidal cast iron could be distinguished from flake iron. Mr. Neemes described the foundry characteristics of ductile iron with special emphasis on its castability, good fluidity, homogeneous structure throughout various thicknesses of casting sections, and slightly greater chilling tendencies. Specific analyses and physical properties of various members of this "family" of ductile iron were next discussed and actual examples of useful castings being made today were appraised. Mr. Neemes concluded with a series of slides after which a discussion period brought forth many interesting sidelights.—*O. J. Myers, Werner G. Smith Co.*

NORTHEASTERN OHIO Chapter of the AFS held its 15th annual Christmas party Dec. 15 at Hotel Carter, Cleveland. L. P. Robinson, Werner G. Smith Co., division of Archer-Daniels-Midland Co., Cleveland, was in charge of the affair. Photos by H. W. Wheeler, Superior Foundry Inc.

Ohio State University

A display of malleable castings and showing of the film, "This Moving World," featured the Dec. 6 meeting of Ohio State University Student Chapter of the AFS. Both the film and the display were presented by courtesy of Lake City Malleable Co., Cleveland, and Columbus Malleable Iron Co., Columbus.

During the day, engineering students were shown through the bus which houses the exhibit of malleable castings. Officials of the two firms were present to answer questions concerning the castings and photographs showing production techniques. The film, showing processing and application of malleable products, was presented during the chapter meeting by Charles A. Fowler, production manager of Columbus Malleable Iron Co.

This month the "distinguished service badge" was awarded to John Eggleston who was chosen as the member who had done most in the preceding month toward furthering the aims of the chapter. At present several of the members are voluntarily helping to overhaul an electric furnace to be used in the university's foundry laboratory. — *Dallas M. Marsh.*

Chicago

CHICAGO Chapter, AFS, on Jan. 10 at the Chicago Bar Association, conducted the second in the series of four roundtable meetings arranged for the current season. Attendance compared favorably with totals established at recent meetings of the group type, despite the fact that the first-Monday-in-the-month schedule was departed from because of the New Year's holiday.

Chapter President W. D. McMillan, chief metallurgist, Farm Implement Division Foundries, International Harvester Co., Chicago, presided at the dinner and general part of the meeting, and Vice President A. W. Gregg, consulting engineer, Whiting Corp., Harvey, Ill., handled preliminaries for the four group sessions which followed.

Lyle L. Clark, assistant foundry metallurgist, Buick Motor Division, General Motors Corp., Flint, Mich., addressed the Gray Iron Division on "Cupola Operation." Ralph A. Clark, metallurgist, Electro - Metallurgical

(*Concluded on page* 190)

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(*Concluded from page 188*)

Co., Chicago, served as chairman.

Speaker for the Steel Division roundtable on the subject of "Resin Bonded Cores" was William Downey, sand technician, Burnside Steel Foundry Co., Chicago, and chairman was John A. Rasenfoss, research metallurgist, American Steel Foundries, East Chicago, Ind.

"Vacuum Die Casting" was the topic considered by the Nonferrous Division, with William B. Scott, metallurgist, Aurora Metal Co., Aurora, Ill., as the speaker. Fred Ridell, plant metallurgist, H. Kramer & Co., Chicago, presided at the session.

Malleable Iron and Pattern Divisions joined forces to consider the subject of "Pressure Plates." Speaker was Kurt A. Miericke, foundry consultant, Chicago, and chairman was H. K. Swanson, owner, Swanson Pattern & Model Works, East Chicago, Ind.

For its next meeting Feb. 6 at the Chicago Bar Association, the chapter has arranged to show the film "Fluid Flow in Transparent Molds," prepared under direction of the national AFS Aluminum and Magnesium Division in connection with its research program.

Saturday, Feb. 18, is the date for the chapter's famous annual "Ladies' Nite" dinner and dance at the Palmer House.

The Chicago Chapter initiated its 1950 educational program, a "Foundry Practice Demonstration" course, on Jan. 9 with an enrollment of approximately 300. Sessions are being held on the second and fourth Monday through March at the Peoples Gas Auditorium. First session was on sand, the second, on Jan. 23, on molding. Subsequent demonstrations are: Feb. 13 coremaking; Feb. 27 melting and pouring; Mar. 13 Cleaning of castings; Mar. 27 inspection.—*Erle F. Ross.*

Metropolitan

METROPOLITAN Chapter of the AFS held its annual Christmas party at the Essex House, Newark, N. J., on Dec. 9.

The party, which was attended by approximately 450 members and guests who enjoyed an excellent dinner and show, was planned by a committee headed by B. E. Beldin, Whitehead Bros. Co., and consisting of D. S. Yoemans, George F. Pettinos Inc.; T. J. Wood, American Brake Shoe Co.; Arthur F. Fischer, Fischer Castings Co.; D. Polderman Jr., Whiting Corp.; William Lawson, Springfield Facing Co.; J. F. Bauer, Hickman, Williams & Co.; H. A. Robinson, Republic Steel Corp.; and F. J. Eliason, Pennsylvania Foundry Supply & Sand Co.—*Carl Szego, Moldcast Products Inc.*

CENTRAL INDIANA Chapter of the AFS met Dec. 5 at the Athenaeum, Indianapolis, to hear Eugene Conreaux (right, above) foundry engineer, Illinois Cereal Mills, Paris, Ill., discuss core and molding sand practice. Linn Burk, left, assistant foundry metallurgist, International Harvester Co., Indianapolis, was technical chairman for the meeting. Photo is by courtesy of staff photographer, International Harvester Co.

Committee Reports to Munitions Board

Members of the Technical Subcommittee of the Foundry Industry Advisory Committee, Munitions Board, meeting at Washington, Nov. 15, heard reports of the latest developments in laboratory tests of nodular cast iron in applications for commercial use. The first meeting of the Technical Subcommittee was presided over by Max Kuniansky, vice president and general manager, Lynchburg Foundry Co., Lynchburg, Va. Frank G. Steinebach, editor, THE FOUNDRY, Cleveland, chairman of the Foundry Industry Advisory Committee, also attended.

Represented at the meeting were the Munitions Board, Army, Navy, Air Force, National Security Resources Board, Research and Development Board, and the U. S. Tariff Commission.

T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa., discussed his company's progress in developing castings from ductile iron. Harold N. Bogart, Ford Motor Co., Dearborn, Mich., reported on tests being made by his company.

Recent developments in foundry methods were discussed as follows: Aluminum, by H. J. Rowe, Aluminum Co. of America, Pittsburgh; bronze and iron, J. S. Roberts, American Manganese Bronze Co., Philadelphia; malleable iron, C. F. Lauenstein, Link-Belt Co., Chicago; magnesium, C. E. Nelson, Dow Chemical Co., Midland, Mich.; steel, G. A. Lillieqvist, American Steel Foundries, Chicago; centrifugal dual castings, Dr. A. E. Schuh, U. S. Pipe & Foundry Co., Burlington, N. J., and cast turbine rotors, C. L. Frear, Bureau of Ships, Navy Department, Washington.

Book Review

Dynamic Equipment Policy, by George Terborgh, cloth, 290 pages, 6 x 9¼ in., published by the McGraw-Hill Book Co., New York, price $3.75.

Industrial management will find this text provides an excellent discussion of sound re-equipment policies. The author is research director of the Machinery & Allied Products Institute and the replacement formula presented was developed by him over a period of many years of study and collaboration with executives in capital goods industries. The text shows the errors in present rule-of-thumb replacement policies and illustrates application of the MAPI formula with numerous examples from actual experience.

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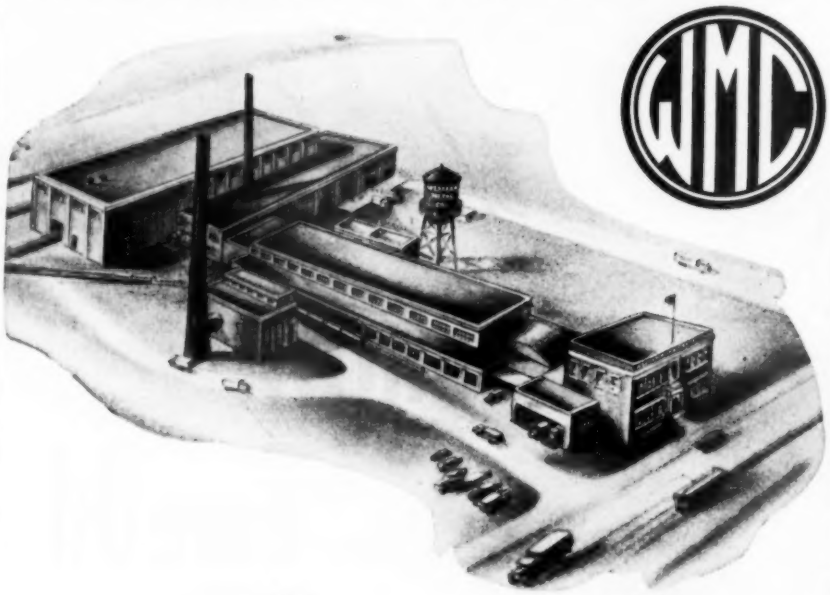

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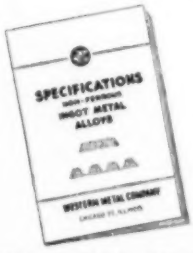

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"Oscars" Awarded To Foundrymen

Belle City Malleable Iron Co. arranged its own Academy Award celebration in Racine, Wis., Oct. 21. A crowd of approximately 2000 employees, their families and friends saw not only a preview of "This Moving World," but also the presentation of "Oscars" to 30 employees who appeared in the film or were directly responsible for helping to produce it.

E. O. Jones, personnel director, in turn presented an "Oscar" to Charles S. Anderson, company president, for his work with the Malleable Founders' Society, which was responsible

for production of the film. The bronze "Oscars," one of which is reproduced here, was designed and cast by Albert N. Weberg, foreman of the pattern shop.

Booklet Discusses Spectrophotometry

Booklet entitled *Spectrophotometry*, by Kasson S. Gibson, covers definitions of spectrophotometric terms, essential parts of spectrophotometers, typical instruments in current use, types of errors which usually occur in spectrophotometric work, and presentation of standard data for checking the calibration of spectrophotometers.

Discussion also deals with instruments and methods for use in the ultraviolet, visible, and near-infrared spectral regions, including photographic, visual and photoelectric methods.

Booklet is available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, at 25 cents a copy.

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The biggest screen for the smallest dollar

The Simplicity 3′ x 6′ Model C Single Deck Screen is without question the biggest screen value available on the market today, and it has always been the lowest priced screen of real capacity ever offered. The 3′ x 6′ screen *actually gives 3′ x 6′* — 18 square feet — of screening area with the famous Simplicity Gyrating Action. This Model C single deck screen is a standard unit *built for service in any industry*. Ideal for cleaning up a dirty stockpile or for making an extra size product outside your regular screening operations. The 3′ x 6′ Model C has all the work-proved Simplicity features, yet is a compact unit that can be installed in your foundry at a saving you won't find elsewhere.

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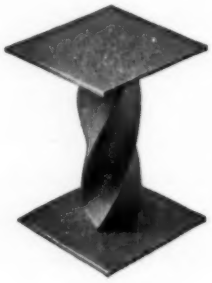
The products on this page represent three of the many items which Federal supplies to the foundry trade. Altogether we have more than 400 different foundry products. Rely on The Federal Foundry Supply Company for your needs.



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The chaplet with everything. The "Twisted Stem" promotes rapid complete fusion. Not deformed, the stem has no weak spot to burn in and permit core shift. Made in a complete range of sizes. Samples of the size you use, gladly submitted.

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Save money by faster sifting, better sand conditioning with a Lowe Electric Sifter. Features: greater screening area, enclosed ball bearing motor, more shoveling room. Write for information. Prompt delivery.

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Proposed Revised Tentative Methods of

PREPARATION OF MICROGRAPHS OF METALS AND ALLOYS

INCLUDING RECOMMENDED PRACTICE FOR PHOTOGRAPHY AS APPLIED TO METALLOGRAPHY

ASTM Designation: E2— -49T

(Concluded from January)

such as Velox No. 1 in that series, will give a photograph of the desired contrast.

(b) Prints shall be developed to a constant time according to the specifications of the manufacturer of the paper; for contact prints (chloride or chloro-bromide papers) this will be a "full development." The prints shall be transferred from development to an acid stop and rinse bath of acetic acid (1.5 per cent).

(c) Even greater care must be exercised in maintaining the quality of the fixing bath for papers than for plates or films, since it is impossible to see whether a print is completely fixed because of partial exhaustion of the bath. The prints shall be fixed for no shorter than 5 minutes and preferably not more than 15 minutes, in a fresh acid hypo fixing bath containing a hardening agent. Care shall be taken that the surface of each print shall be exposed to the bath for this time, probably by frequent stirring of all of the prints in the bath. The prints must be kept well immersed and face up to prevent localized bleaching. No more than one hundred 4 x 5-in. prints per quart shall be fixed in a bath before it is discarded. The bath shall not be replenished with fresh fixing bath but discarded entirely. Because of danger from stains from incompletely fixed iodide, a bath once used for negative materials must not be used for prints.

The fixed prints shall be washed for 1 hour in running water or by giving at least twelve changes of water after soaking for 5 minutes. The hypo in the paper stock is that which is difficult to remove; it may cause discoloration of the prints as they age. If there is any doubt of the efficiency of the washing, the water drained from some prints shall be tested for hypo with alkaline potassium permanganate according to standard practice. A blank shall be run on the wash water.

(d) Since the scale of a glossy print is somewhat greater than that of a matte one, and it can reproduce finer detail, the former shall be used in metallography. A commercial ferrotype plate or its equivalent not only imparts the maximum gloss but forms a convenient method of drying the prints flat. Some care is required to keep the surfaces of such plates in good condition. Plates of inconel or chromium-plated brass, which have been previously wiped with a solution of paraffin wax in benzol or other solvent and then wiped dry, may be used.

APPENDIX

RECOMMENDED PRACTICE FOR THE CARE OF THE EYES WHEN USING A METALLOGRAPHIC MICROSCOPE

All optical instruments of reputable make are so designed and optically corrected that there should be no discomfort to the user, if the eye is normal or corrected with proper spectacles and proper illumination is used, not forgetting that some eyes will bear brighter illumination than others.

In the microscopical examination of metals it is customary to use illuminants of high intensity to secure adequate illumination in photography. With the ordinary microscope or other optical instruments an illumination of 3 to 5 foot candles at the eyepiece is generally sufficient, and it should be in the examination of metals.

The carbon arc is a very bright light source and, while desirable for photography, in order that the time of exposure of the photographic plate may be reduced as much as possible, is, nevertheless, dangerous for visual observation if not properly controlled. If a reduction of the illumination is made by means of diaphragms, it results in a reduction of the effective aperture of the objective and therefore the resolving power, that is, the ability of the objective to separate two closely situated points in the object. The back lens of the objective, when seen with the eyepiece removed, should be filled with light if full resolving power is desired.

Filters, placed between the light source and the vertical illuminator, as well as the colored glass cap fitting over the eyepiece, reduce the illumination and will generally be found sufficient for lamps such as the ribbon filament. If, however, an arc lamp is used, these filters will be found not to be sufficient to reduce the illumination for continuous observation, and if the outfit is so used a harmful blinding effect will be experienced. A remedy for this is the use of filters of neutral smoke glass placed between the light source and the vertical illuminator.

Several degrees of density are advisable, as specimens vary and observers vary in light sensitiveness. The darker filters will probably require the protection of a water cell as they absorb considerable heat and may break if unprotected.

Proposed Revised Tentative Methods of

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For visual observation the illumination should be reduced to the lowest intensity that permits satisfactory results. Details appear to better advantage when glare is eliminated. If much visual work is to be done it would be advisable to have two interchangeable sources such as a ribbon filament for visual work and an arc lamp for photography.

It is the custom for trained observers with the microscope to keep both eyes open at all times. If one eye is closed a muscular strain is placed upon the eye in use. If one finds it difficult to keep both eyes open, an eyeshade may be placed before the unused eye. Such a shade may be made of cardboard, or a shade of hard rubber can be purchased for a nominal sum. Several metallurgists are using binocular eyepieces which permit the use of both eyes.

Observers who wear glasses often remove them when using the microscope. If the defect in the eyes is limited to near or far sightedness, the deficiency may be corrected by focussing the microscope. If, however, the observer has astigmatism, a defect in which one meridian of the eye focuses at a different distance from another meridian, correction cannot be made by adjustment of the instrument. If the cylindrical power of one's spectacle lenses is one diopter or less, very little trouble will be experienced if the spectacles are not worn. Where greater cylindrical power is necessary, the spectacles should be worn or some other correction applied.

If it is found inconvenient to wear spectacles, owing to the difficulty in placing the eye at the eyepoint of the eyepiece, a cap containing a lens corresponding to the observer's prescription can be placed over the eyepiece. The axis of the cylinder should be plainly marked upon the cap and care used to place this axis in position upon the microscope as given in the oculist's prescription.

In conclusion, three cautions might be noted, as follows:

1. An illumination brighter than is necessary to make observations should not be used.

2. The unused eye should not be closed.

3. Spectacles should not be removed unless other means are provided for correcting the eye.

DATA ON ALUMINUM FOUNDRY PRACTICE

Casting: There are three factors which influence the quality of castings. The first factor is the great affinity that molten aluminum has for gases. Hydrogen is the most common and may originate from water vapor in the atmosphere or hydrocarbon fumes from open flames. During the solidification of the casting, the gas may produce porous castings containing pin holes. As a general rule the lowest melting and pouring temperature that is consistent with properly filling the mold should be maintained. Usually a furnace temperature of 1300 to 1400° F (700 to 760° C) is the best range, depending upon the melting point of the alloy. This rather narrow temperature range requires close temperature control.

Another factor is the ease with which aluminum forms an oxide by combining with oxygen in the air. Agitation and high temperature tend to accelerate this reaction and therefore must be kept to a minimum. Excessive oxide may be reduced by fluxing, but fluxing should not be substituted for proper melting and handling of the metal.

A third factor is contamination of molten aluminum with foreign matter and such metals as iron. This is a serious source of inferior quality castings. Cleanliness of equipment and proper use of protective coatings on tools will go far toward overcoming this condition.

The basic objective in satisfying conditions for the production of a sound casting is essentially to flow the molten metal into the mold in such a manner that solidification proceeds progressively from a point located farthest from the ingate or port of entry. Adequate reservoirs of molten metal must be available to feed and maintain progressive temperature gradients at those sections of the casting where unbalanced solidification might occur. In sand molds, risers may be provided for this purpose.

In sand casting, it is good practice to make the pouring sprue rectangular in shape, so that a funnel effect is avoided. This reduces the tendency of the molten metal to draw air into the mold, forming oxide and possibly air pockets. A choke at the bottom of the sprue also helps reduce this danger and minimizes turbulence.

To minimize turbulence further it is often possible to provide under cut just below the sprue, which cushions the metal as it enters the ingate or runner.

The casting will be only as good as the metal that enters the mold. It is vital, therefore, that the melting pot be skimmed carefully and poured with minimum turbulence. Too high a pouring height should be avoided.

Finishing: Castings are finished by sand blasting, machining, heat treating, chemical or electrochemical treatment. While only aluminum-copper, aluminum-silicon-magnesium, and aluminum-magnesium alloys respond to heat treatment, all the casting alloys may be sand blasted, tumbled, treated chemically or electrochemically to produce a better finish.

From Reynolds Metals Co., *Aluminum Alloys and Mill Products Data Book*.

the new HANDY SANDY increases molder's output 50 molds per day

at the MICHIGAN WHEEL COMPANY
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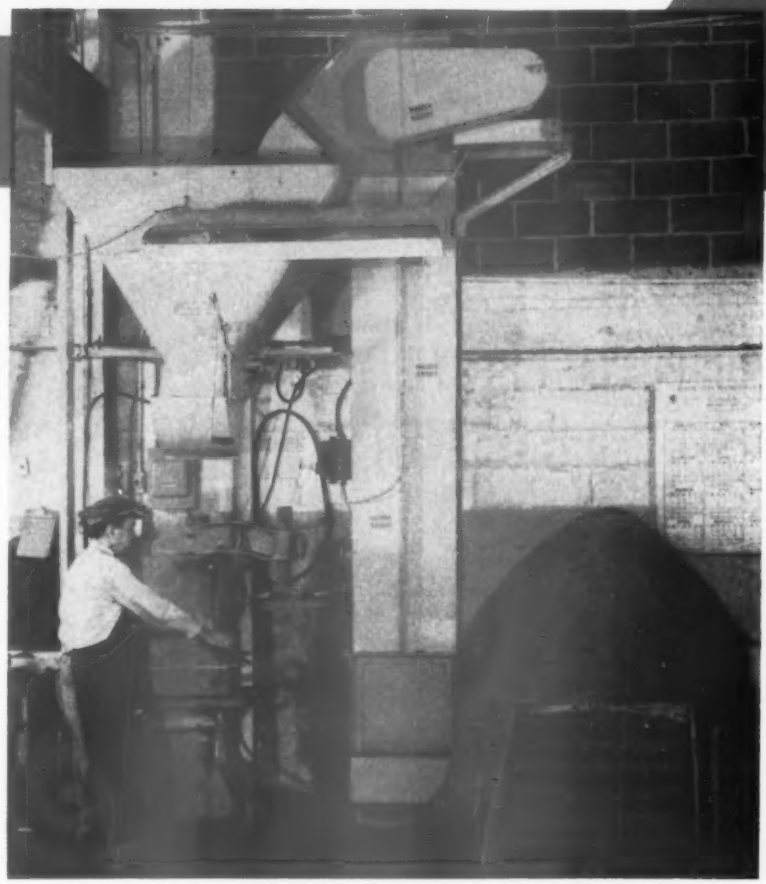

Test proves Cost Reducing Advantages of HANDY SANDY

When a molder is shoveling, he is not producing. Replace his shovel with a Handy Sandy and he will turn out more molds for you at less cost per mold. This was the result when the Michigan Wheel Company tried a Handy Sandy in casting 4 pound propellers from Manganese Bronze. When filling the flasks by hand, one molder produced from 50 to 55 molds per day. NOW, with a Handy Sandy supplying the sand, the same man turns out from 90 to 100 molds daily — and still "feels like working another shift."

According to Mr. W. R. Royce, Foundry Superintendent, the sand is more thoroughly conditioned and all lumps are eliminated by the extra aeration of the Handy Sandy. Hand riddling is no longer necessary due to the improved condition of the sand. Castings have a better appearance, there are fewer rejects and all excessive grinding and finishing have been eliminated.

"What's more," says Mr. Royce, "The Handy Sandy takes no more space than the sand heap. It's ideal where space is at a premium. We are going to equip the Foundry throughout."

GIVE YOUR MOLDERS A LIFT WITH A HANDY SANDY AND WATCH YOUR PROFITS GROW.

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IT'S A CLARK ELECTRIC

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Anti-friction bearings, spiral-bevel gears, low-pressure hydraulic system, hydraulic brakes virtually eliminate vibration and wear.
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Dependable!
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CUPOLA DUST COLLECTION

(*Continued from page* 85)

to 1000 microns; in specific gravity from 1.5 to 7.5. It is partially magnetic, corrosive, and abrasive, and contains coke, ash, compounds of sulphur, and oxides of silicon, aluminum, calcium, magnesium, manganese, iron, zinc, lead, and possibly other elements getting in with the charge.

Fig. 2 shows a series of four lines representing samples of dusts from several sources. Their relative geometric mean sizes can be judged by their vertical positions along the 50 per cent size line. Thus, the entire range of solids from the few cupolas represented by curve 2 are shown to be somewhat coarser than the dust produced by the burning of pulverized coal.

Actual analyses of dust samples seldom produce truly straight lines on these co-ordinates. Nevertheless, a representation of this kind is far more significant than specification of a single figure for average particle size. The counterpart of a straight-line logarithmic-probability plot can be expressed in a number of ways:

(a) 10 per cent below X size, 10% above Y size.

(b) 50 per cent through X-mesh screen, 90% through Y-mesh.

(c) 50 per cent size X, standard deviation S.

(d) 10-50-90 cumulative per cent undersizes: X-Y-Z. Note that this method can describe a plot with a slope in the 10-50 range different from that in the 50-90 range, when a straight line does not produce a satisfactory representation of the data.

Particle size, shape, specific surface, and specific gravity (the 4 S's) are all integrated into one value when direct measurements are made of the "terminal velocity" distribution of a dust sample by elutriation or sedimentation. However, cupola flue dusts have not been studied by either of these procedures to a degree that will permit a discussion of terminal velocities, and thus it is better at this time to refer to screen and subscreen ratings in size groups on the micron scale. Fig. 2 has been arranged, therefore, on the universal micron scale, rather than either terminal velocity or screen mesh sizes.

The particulate matter near and below 1 micron is chiefly responsible for the optical density of combustion effluents. While some of the submicron and even submicroscopic particles will be removed in the course of gas washing, we are not so much

concerned with this fraction of the solid matter for the present. There is a good deal of work required on particulate matter above 10 microns before we can apply equipment that is truly effective below this order of size. This position is reasonable, since the effluent from the gas cleaning equipment is discharged out-of-doors.

Carbonaceous smoke that might emerge from the cupola should be prevented at its source, which is far more practicable than removing submicron particles from the gas by cleaning. Incomplete combustion of oily or tarry substances in the cupola charge will cause such smoke, as also will burning of wood during the light-up period. A pilot gas burner opposite and slightly above the open charging door serves as an igniter and helps to keep the gas burning, especially desirable in the event of a smoke nuisance due to oily scrap in the charge.

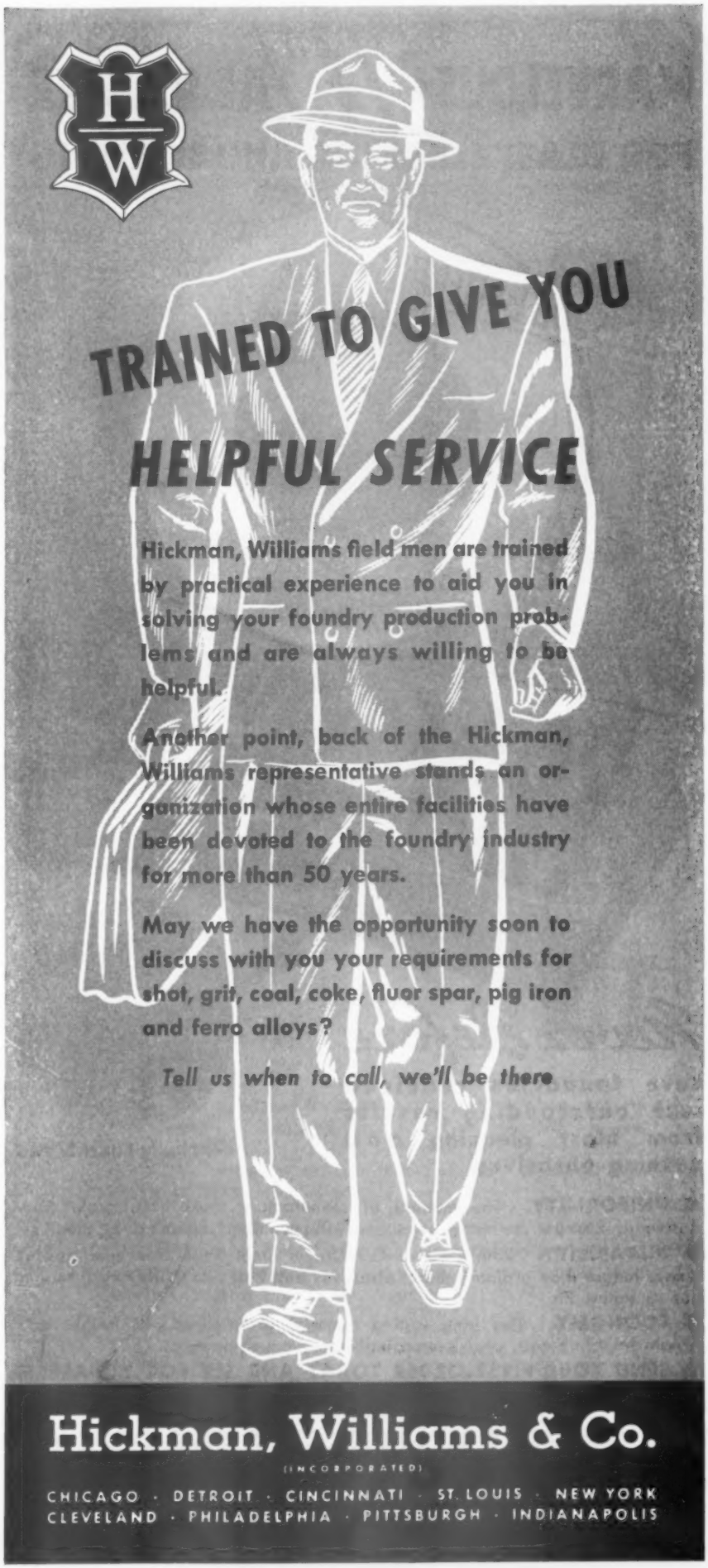
Obtain Complete Combustion

Since the fuel charge is coke or charcoal, it contributes only slightly to any visible emissions. As continually stated in the field of coal smoke abatement, the remedy is not the installation of elaborate cleaning devices capable of removing particulate matter less than 1 micron in size, but rather attempts to make the burning process itself more complete.

It is generally agreed among smoke abatement authorities that the Ringelmann scale of apparent smoke density has only slight connection with the weight of materials discharged from a combustion stack. Some years ago Marks[2] drew attention to the difficulties in applying the several visual methods of estimating smoke density. Nevertheless, as an optical rating easy to comprehend, the Ringelmann scale does bear some relation to community attitude toward a given stack, and accordingly its use persists in smoke abatement and air pollution regulations.

Quantity of Cupola Emissions — The quantity of dust passing up the stack can be related to the quantity of iron melting; it apparently varies from 10 to 50 pounds per ton of iron, according to data available at this time. Translated into grains per cubic foot of discharged gas at normal outdoor temperatures, this represents a dust concentration of about: 3 to 15 grains per cubic foot with a closed charging door; 0.2 to 10 grains per cubic foot with an open charging door.

Until further detailed investigations have been reported, the quantity of materials discharged by the cupola is estimated to be on the order of the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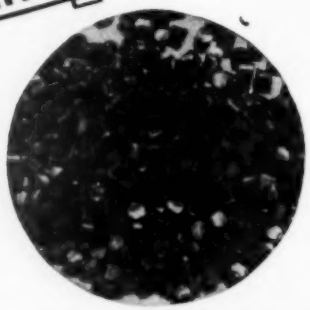

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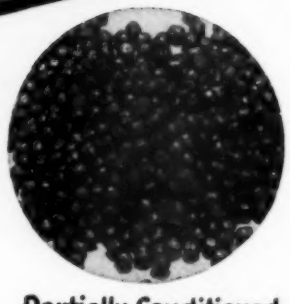

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following relationships:

1500 ± 500 pounds of combustion gas leaving the melting zone per hour per square foot of internal cross-sectional area of the cupola (slightly more than blast air weight).

6000 ± 4000 pounds of combined gas and air discharged from the cupola stack per hour per square foot, with the conventional open charging door.

15 ± 10 pounds of gas-borne solids emitted from the stack per hour per square foot.

1.5 ± 1 pound of solid and gaseous sulphur discharged per hour per square foot, assuming maximum 1 per cent sulphur in the coke.

By stating the above relationships on the basis of mass velocities, or pounds of solids per hour per square foot (lbh/sq ft) the air and gas temperature and pressure variables are eliminated. From the cupola size data in Table I, estimates can be made of the total mass flow rates in pounds per hour. Conversion from weight to volume rates of flow at atmospheric pressure is readily made by the approximate equations:

$$\text{Air:} \quad \text{cfm} = 25 \frac{(t + 460)}{(1000)} \text{ lbm}$$

$$\text{Gas:} \quad \text{cfm} = 24 \frac{(t + 460)}{(1000)} \text{ lbm}$$

where: cfm = cubic feet per minute, lbm = pounds per minute, t = temperature in °F, ranging generally from 600 to 1600 degrees for untreated and undiluted stack gas.

The great variation in the quantities of stack gas emerging from the cupola is due to intentional as well as unintentional differences in its use. These differences are found in the efficiency of melting, degree of control over air weight delivered, whether the charging door is left open continuously, backdraft at the top of the cupola caused by a dust collecting device, height of stack, heat value of coke, whether cold or hot blast, dry or humid, and other factors.

Kling[3] reported that dust loading of blast furnace gas at 60° F and 30 inches of mercury is approximately in proportion to the gas velocity, in the ratio of grains per cubic foot = 0.29 gas velocity in feet per second. Thus, at a gas velocity of 20 fps., or 1200 fpm, the loading on this basis would be 5.8 grains per cu ft. The directness of this ratio probably is due to the predominant effect of the large particles in the gas stream. At 20 fps, a 5000-micron irregular-shape, porous coke particle would be carried upward, and at the same velocity at 1000-micron particle of iron would be lifted out of the stack. (Note that

in the case of a blast furnace, the combustion gas is not diluted with air entering the stack.)

Although these facts are of interest, it is well to remember that the physical and chemical properties of materials going into the blast furnace are considerably different than the nature of the cupola charge.

Coke is brittle, and rough handling while charging will produce an excessive amount of fine particles. Dropping these lightweight coke particles into the rising gas stream transfers them promptly to the gas cleaning equipment. It is well to remember that a charging bucket aggravates the carryout of fine particles at the moment of dumping because of the reduction it causes in the cross-sectional area available to the combustion gas. The gas is momentarily accelerated in passing around the bucket, and its "airlift ability" or dust transport velocity is increased correspondingly.

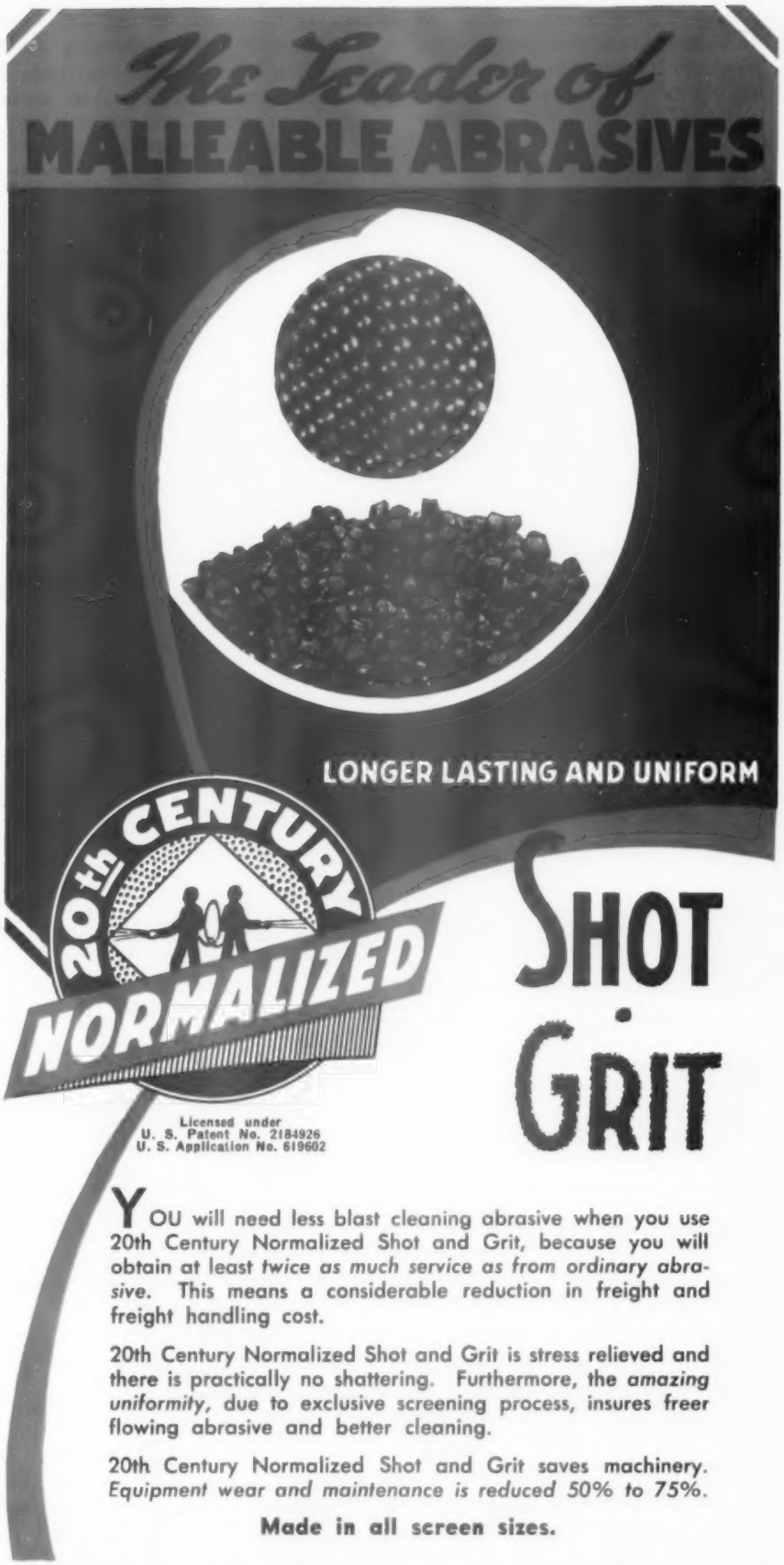
Likewise, the addition of scrap metal in the form of fine chips not densely briquetted will allow the gas stream to lift some of this metal out of the stack before it has reached the fusion temperature near the melting zone.

Combustion Gas Dilution—One factor to be considered in the design of cupola dust collection systems is the dilution experienced by the combustion gases as they rise past an open charging door and mix with the air induced there. Whether this effect is an advantage or a disadvantage depends on the destination of the combined stack gases, and the attitude toward them from an air pollution viewpoint.

The advantages of diluting the combustion gas with induced air include: a cooling effect (which may be offset by the heat of combustion in case the temperature and CO content are high enough); a lower concentration of both gaseous and solid matter; a fresh supply of oxygen to burn the carbon monoxide in the waste gas and possibly any carbonaceous smoke reaching this point; and a ventilation effect on the charging floor due to the removal of air through the charging door.

The pre-cooling effect of dilution is desirable when a wet system of dust collection is used and the waste gas is discharged to the atmosphere without attempt to recover its heat value. Cooler gas has less volume and carries away less water vapor, an important item in communities where water is at a premium.

The disadvantages of combustion gas dilution appear essentially under the same categories, but from an opposite viewpoint. If recovery of part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of the heat content is desired, cooling the gas with air will reduce the amount of sensible heat that can be recovered. Cooling also will make it more difficult to recover the latent or potential heat in the carbon monoxide by its combustion, which requires both a sufficient concentration (13 per cent or more in air) and a high enough temperature for ignition (1000° F or more).

Excessive cooling of the combustion gas also reduces thermal updraft, with the possible danger that carbon monoxide will come out of the charging opening into the breathing zone of workmen at that level, especially with a large charging door.

Dilution of the finer particulate gas contaminants makes them more difficult to remove, and requires larger capacity gas cleaning equipment. Although dilution implies a certain amount of deceleration of the gas velocity by cooling when only natural draft is available, it may be less effective in permitting heavier particulate matter to settle than moderate expansion of the initial gas stream without dilution.

Furthermore, dilution of contaminants does not reduce the number of pounds emitted per hour. Air pollution control authorities are becoming more concerned about the total quantities of contaminants discharged into community atmospheres, and are considering changes in their regulations to give better control over this index of pollution. The dilution factor for power plant flue dust has been under control for some time by requiring that stack gas analyses be adjusted to a condition of not over 50 per cent excess air, or to a carbon dioxide concentration of around 12 per cent.

With the above considerations in mind, it is best to know the amount of dilution of combustion gas with normal air before attempting to correlate the quantities of contaminants issuing from the cupola with the weights of metal charged or melted. This requires only that both the blast air and the gas emission weights be stated, since the combustion gas is only slightly heavier than the air going into the cupola. It is better, however, to estimate the airflow into the charging door as well, and thereby establish a more certain control over reliability of the data.

Allowable Emission Rates — At least in one community—Los Angeles county—the opportunity to meet air pollution regulations by the simple expedient of diluting stack gases with air came to an abrupt halt with the passage of new regulations effective Apr. 5, 1949. These regulations not only specify an upper limit of 0.4 grain of solids per cu ft of gas, but they also set a ceiling of dust emission at 40 lb per hr from any one stack. This does not mean, however, that all stacks may emit 40 lb per hr. Maximum permissible emission is determined by the total weight of raw materials entering the process, and only when this weight reaches 60,000 lb per hr does the ceiling value of 40 lb apply. For smaller raw material weights, the maximum discharge weight is correspondingly reduced, although not in direct proportion. It ranges from 0.067 per cent at 60,000 lb up to 0.48 per cent by weight at 50 lb per hr. (The relationship in the range of 300 to 30,000 lb is approximately: $We = 0.042\ Wp^{0.6}$, where We is the emmission rate and Wp is the the total process raw material weight, both in pounds per hour.)

Fig. 1 is a graphical presentation of the relationships between several methods of specifying the allowable emission of solid materials from dust collecting equipment. By use of a correction chart at the right of the

(*Continued on page* 204)

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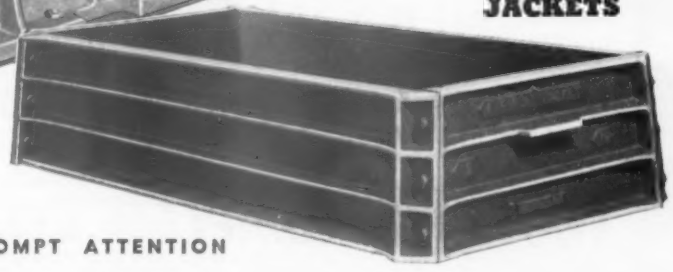

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(*Continued from page* 202)

graph, various temperature conditions can be converted to the reference scale, which in this case is based on an arbitrary gas density of 500 grains per cu ft. This density has been chosen admittedly for its mathematical convenience, a highly desirable feature in a field so much confused with multiple units and reference temperatures.

From the graph it is readily seen that compliance with an emission concentration of 0.4 grain per cu ft of gas at 100° F, or a dust concentration of 0.08 per cent by weight, requires a cleaner capable of separating 80 per cent of the solids from the gas stream when the initial loading is described as: (a) 2 grains per cu ft; (b) 4 lb per 1000 lb of gas (4 lb per kilopound); or (c) 4 grams of solids per kilogram of gas.

The area lightly shaded with horizontal lines indicates the range applying to most cupola dust collection problems. A few cupolas will discharge solids at a substantially lower concentration due to high rates of gas dilution before release to the atmosphere. In fact, with sufficient dilution, it is possible to comply with many ordinances without the installation of gas cleaning devices.

Limits Amount of Emission

Section 609-B of the new "Smoke Control Ordinance of Allegheny County, Pennsylvania," effective June 1, 1949, provides that:

"No person shall cause, suffer or allow to be emitted into the open air from any cupola contracted for, under construction, or in operation subsequent to the enactment of this Ordinance, fly ash in the gases to exceed 0.85 lb per 1000 lb of gases, except it shall not be required that the fly ash eliminated shall be greater than 75 per cent of the total fly ash. Cupolas contracted for, under construction, or in operation prior the enactment of this Ordinance shall be subject to the requirements of this section five (5) years subsequent to the enactment of this Ordinance."

Wind velocity and direction are important as they affect the pattern of distribution of the heavier solids. When the velocity is around 5 miles per hour, most of the dust settles on the foundry roof near the cupola; when the velocity is 25 miles per hour, a substantial portion of the heavy particles deposits on adjacent roofs and grounds. However, for the finest solids and for gaseous contaminants, a high wind velocity may be considered an advantage in some communities, since it tends to disperse and dilute the contaminants

throughout a larger mass of atmosphere.

Because there is interest in both the deposited heavy dust and the fine particulate matter that remains in suspension for some distance from the stack, it is customary to determine the total weight of solids in cupola gases, including all sizes discharged from the stack. With such a procedure, it is rather important that some information also be given concerning the size distribution of the dust, in order to assist the dust control engineer in devising methods having a proper combination of cleaning stages for economical performance against the various particle size groups.

Solid and Gaseous Sulphur Compounds—If the sulphur content of the coke can be kept below 1 per cent, which is desirable both metallurgically and meteorologically, the total sulphur concentration in the stack gas will be less than 0.1 per cent by weight, even without dilution by air entering the charging door. This amount of suphur should not be translated wholly into the gaseous form SO_3 when predicting the possible destination of sulphur in the charge. The probable distribution of sulphur between the gaseous and solid forms is a matter of some speculation at this time, since very little data has accumulated on this point. Only recently, as an outcome of the widespread publicity on the smog-forming potentialities of sulphur dioxide and trioxide, has there been any concern for the very small amounts of sulphur emitted by foundry cupolas.

Table II is an outline of the method of analyzing the origin and destination of sulphur in cupola melting. For each case a similar analysis can be made in the absence of stack gas determinations for sulphur. However, the procedure outline is dangerous if the restrictions on sulphur emission are severe. Only by careful sampling and analysis of the effluent gas over a sufficient period of time to provide a convincing record of the average concentration and its range of movement, can a proper appraisal be made of the extent of air pollution by a given source.

Hemeon and Hatch[4] of the Industrial Hygiene Foundation, Mellon Institute, have indicated that ". . . sulphur dioxide has been studied extensively with respect to its capacity for damaging vegetation. The maximum safe concentration has been determined, and it is now considered good practice to operate plants producing this gas in such a manner as to avoid ground-level concentra-

(*Concluded on page* 208)

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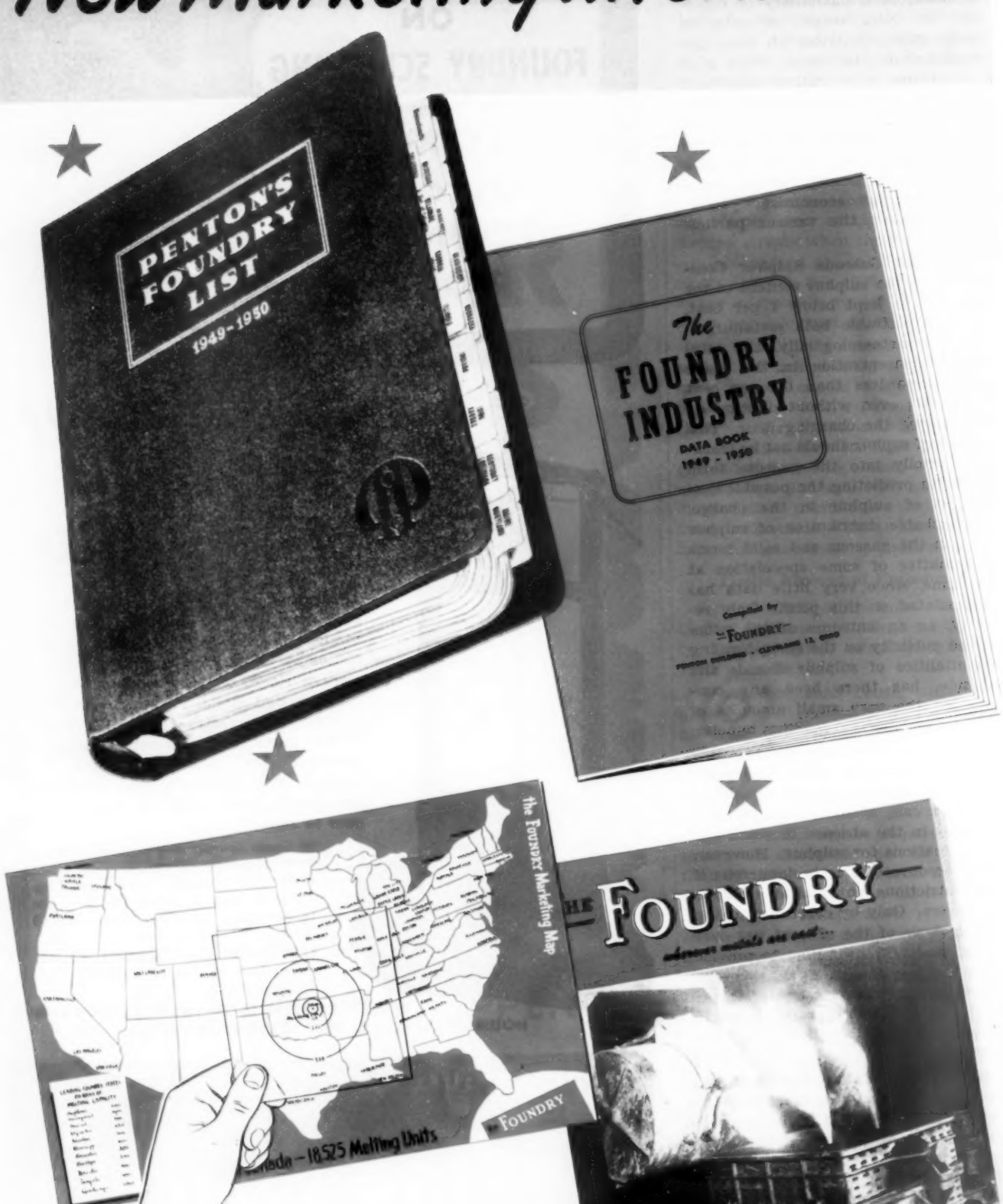

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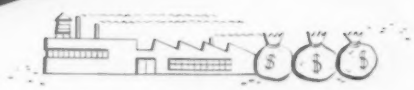

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(*Concluded from page 205*)

tions in excess of 0.5 to 0.75 part per million (by volume). This standard is unique in that no other atmospheric contaminant has received such scientific assessment."

The Los Angeles county air pollution regulations permit the discharge of 0.2 per cent or 2000 parts per million by volume of sulphur compounds, computed as sulphur dioxide, at the point of emission. The relationship between stack concentration and ground-level concentration can be estimated in general order of magnitude, but only by extended air and gas sampling can the results be thoroughly convincing, in the event of controversy. It appears, however, on the basis of all data available, that the concentration of sulphur dioxide at the point of discharge from most foundry cupolas will be far below 2000, and well below 1000 parts per million.

Sampling and Analysis—It is not within the scope of this discussion to present the details of gas sampling and analysis of cupola emissions. A thorough project involves elaborate equipment capable of separating the constituents into several fractions for analytical treatment. It can be readily appreciated that such a project would be in the nature of research, and that routine or periodical testing for emission control purposes must be limited to the essentials established by the few comprehensive studies that have been and will be made. So far, it seems evident that determination of total solids concentration or mass emission rate, and separation of the collected material into several size ranges to indicate its distribution, will satisfy most current regulations. In a few areas where adverse topographical or meteorological conditions prevail, it may be necessary to add gaseous and particulate sulphur determinations to the sampling project.

Available sampling procedures can be adapted to cupola gases even though temperatures may be quite high[5, 6]. It is best to have such work done by testing laboratories, consulting chemists or engineers, or specialists in the field of air pollution control and smoke abatement.

Where continuous observation of the character of cupola emissions is desired, it is possible to adapt the recording and indicating instruments developed for blast furnace and power plant emissions[9, 13]. This will be particularly valuable in controlled research on the performance of various systems of gas cleaning where simultaneous samples before and after the cleaner are desired, and where variations in magnitude and with time are factors to be examined.

(*To be concluded next month*)

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OLIVER BUILDING PITTSBURGH 22, PA.

Describes Control of Cupola Dust

A booklet entitled "Cupola Dust Suppression" has been prepared by the Gray Iron Founders' Society. Its contents are based on results of a nation-wide survey among authorities to provide specifications, operating data and cost of all of the various types of cupola dust suppression units now being used. The booklet has been distributed to society members.

Efficient Scheduling

(*Continued from page* 93)

the corerooms for reinforcing are produced in a separate department. Each separate size and shape of wire and rod is designated by a symbol number and a sample of each is mounted on these boards (Fig. 11) as a reference. Orders received by this department show the quantity required and the wire symbol number so the supervisor has only to check from the board to determine the size and shape of wire to be produced. As indicated in Fig. 11 there are many thousands of different sizes and shapes. Facilities are also provided for straightening and reclaiming all rods larger than 3/16-in. diam.

The production of castings from a great variety of patterns with extremes in lot sizes requires close co-ordination between the molding and core departments. We accomplish this by scheduling the work on every machine in each department. Upon receipt of our work orders each month, a machine burden of all departments is prepared by our IBM system based on time-study time, scrap allowances and efficiency of each department. This burden is a total of all new work orders plus any unfinished orders of the previous month.

Fig. 12 is a recap of the burden on all molding units prepared by our Foundry Planning from the tabulated foundry burden previously mentioned, and is supplied to the foundry manager, foundry superintendent and foundry material control supervisor.

This indicates the units that are overburdened, so that provisions can be made to shift the work from one unit to another wherever possible and thus even up the work on each molding unit.

For scheduling purposes a foundry production follow-up sheet, shown in Fig. 5 is prepared by the scheduling department for each unit. The molding department is divided into two groups; the first group, which we consider our large molding units, is handled by one scheduler while the second group, which we consider our small molding units, is handled by another scheduler. These men work directly from the foundry production follow-up sheet. This provides them with all the pertinent information necessary to fully burden each machine on each molding unit. As the part number is scheduled it is posted on the follow-up sheet and again posted when made. In this way the scheduler has before him the status of all jobs at all times.

Fig. 13 is a typical daily foundry schedule for one of our molding units which is prepared approximately four days ahead of the date of cast. It is a work sheet for the supervisor and provides him with the part number, the pieces to produce, schedule number, the flask that is to be used and the per cent of scrap the last time the job was run. The scheduler, in preparing this work sheet, must take into consideration the interchangeability of flask and machine combination, every effort being made to eliminate the changing of flasks so the maximum of production can be produced from each machine on a given day.

Fig. 6 is a typical daily core machine schedule prepared by the coreroom scheduler. It is a work for the coreroom supervisor, providing him with core machine number, part number, core symbol, cores to be pro-

ONE CUPOLA LINING LASTS
THREE TIMES AS LONG-IT'S BUCKEYE!
Buckeye Silica Firestone's high resistance to heat and abrasion results in much longer life for linings and patches in the melting zone of cupolas.
In many leading foundries, Buckeye has proved its superior ability to withstand severe conditions of long, continuous heats.
Because it is the best you can buy, Buckeye deserves your consideration. May we tell you more about its economy and efficiency?
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1740 E. TWELFTH ST. CLEVELAND 14, OHIO
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"FOR THAT EXTRA SERVICE"
SILICA FIRESTONE

duced, plate size, sand mixture, and burden hours for machine. This is placed at each machine, and as the cores are produced they are checked off by the operator so that the supervisor on each shift can follow his production. Here again a scheduler must take into consideration the interchangeability of coreboxes, core plate sizes, core driers, and oven burden.

Fig. 4 is a summary of the burden of all machines in the core room and is prepared after all machines are fully burdened. This indicates whether any machine is overburdened, and in this event it becomes necessary for the molding scheduler to make the necessary changes on the molding schedule to balance up the burden in the coreroom. This requires rescheduling of jobs with less cores or solid jobs.

This may seem like a complicated procedure, but actually it is more simple than it appears. It has always worked efficiently and enabled us to meet our schedules economically.

Naturally, the problems of interchangeability of flasks and machines in the molding departments, as well as interchangeability of coreboxes, core plates and core oven burden in the core room, multiply with the greater variety of patterns and the extremes in lot sizes. However, we feel that castings can be made economically if these problems are considered in their proper light and with adequate equipment.

Meehanite Group Holds Meeting

Manufacturers of Meehanite castings in the United States held their 24th annual convention at Hotel Carter, Cleveland, Nov. 2-5. During the three-day meeting, attended by more than 150 foundry representatives of over 35 companies, 31 papers covering all phases of foundry operation, production, and sales, were presented.

Of particular interest to the group was a symposium on the production of nodular Meehanite castings which included a complete analysis of the material, methods of its manufacture, and the study of its future sales potential.

A feature of the meeting was the presentation of a gold medal plaque to Oliver Smalley, president, Meehanite Metal Corp. Mr. Smalley has guided the company for 25 years.

New Steel Castings Chart Offered

Factual engineering data on steel castings are incorporated in a comprehensive chart published recently by the Steel Founders' Society of America as an aid to design engineers and purchasing department engineering staffs.

The chart, compiled in connection with the society's research and product development program, serves as a reference guide to economical production of steel castings. Tabular listing of all general engineering types of steel castings, classified according to tensile strengths, is included. Data also include indicated engineering and design applications, current specifications, and typical specifications for special tensile grade requirements. Ready-reference data on specific yield point, elongation, reduction of area, hardness and impact evaluations, endurance limits, modulus of elasticity, machinability, and types of heat treatments, are also shown.

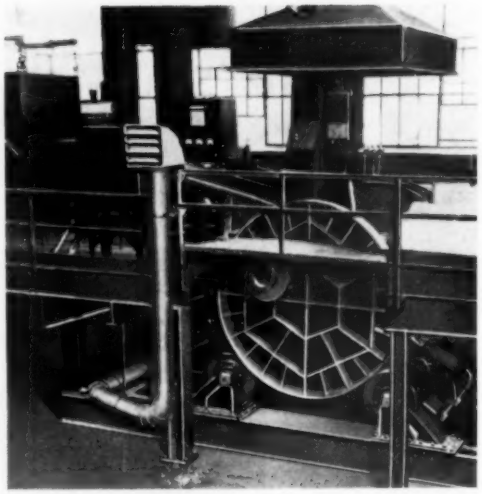
Copies may be obtained from the society, 920 Midland Bldg., Cleveland 15.

Scovill installs WORLD'S LARGEST AJAX-SCOMET Electric Induction Furnace

FOR faster melting, lower melting losses, close temperature control, and complete dependability in quality results, Scovill Manufacturing Company chose the 1000 KW. Ajax-Scomet Electric Induction Furnace for its new plant. It is the largest and most powerful electric melting furnace ever made for brass.

Holding capacity is 20,000 pounds, with an hourly melting rate of 5½ to 6 tons. Under controlled conditions, molten metal is supplied to continuous casting machines for the production of brass strip of unprecedented size.

Ajax engineers bring you over thirty years' experience in the induction melting field. Ajax-Scomet Electric Induction Furnaces offer distinct advantages in cost reduction and manufacturing efficiency.



One of three 1000 KW. Ajax-Scomet Electric Induction Furnaces, for melting brass, recently installed at Waterbury, Connecticut for the Scovill Manufacturing Company.

AJAX ENGINEERING CORPORATION, Trenton 7, New Jersey

AJAX TAMA-WYATT INDUCTION MELTING FURNACE

Associate Companies: AJAX METAL COMPANY, Non Ferrous Ingot Metals and Alloys for Foundry Use
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., INC., The Ajax-Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

Changes in Belgian Foundry Group

Ivan Lamoureux, one of the founders of the Association Technique de Fonderie de Belgique, has been elected its president, succeeding Rene Deprez, who has served 4 years in that office. Mr. Deprez, a graduate of University of Liege, is managing director of a foundry in Herstal. He is serving as president of the International Committee of Foundry Technical Associations this year. Mr. Lamoureux, following studies at Athenee Royal and Ecole Industrielle of Verviers, became a member of the foundry firm of Lamoureux Brothers, which was destroyed during World War I. He has been engaged in manufacture of foundry equipment since 1919. Well known as a writer and speaker on foundry techniques, he also invented several foundry devices, including a system of pouring at low pressure.

Jacques Foulon Ivan Lamoureux

Jacques Foulon, a graduate of Liege University, has been named administrative secretary of the Belgian association, succeeding Edwin Commins, commercial manager of Les Fonderies Magotteaux, manufacturers of wear resisting irons. Mr. Foulon, an engineer in the Foulon Foundry, founded by his great grandfather in Liege, is also technical consultant to the Foundry Equipment Co., there. His address as secretary of the association is 195, rue St. Leonard, Liege, Belgium.

Round Chain Marks 80th Anniversary

The Round Chain Organization in December marked the 80th anniversary of its founding with appropriate ceremonies in plants of five associate companies. Established in 1869 by the late David Round, the present president is Raymond L. Round, grandson of the founder.

Associate companies in the organization are: Cleveland Chain & Mfg. Co., Cleveland; Bridgeport Chain & Mfg. Co., Bridgeport, Conn.; Round California Chain Co., So. San Francisco and Los Angeles; Seattle Chain & Mfg. Co., Seattle, and Woodhouse Chain Works, Trenton, N. J.

Book Review

Production Processes, Their Influence on Design, Vol. I, by Roger W. Bolz, cloth, 368 pages, 6¼ x 10 in., published by the Penton Publishing Co., Cleveland. Price, $10.

The author, who is associate editor of *Machine Design*, has prepared this excellent volume from an extensive series of articles which have appeared in that publication since 1945. The material was prepared to assist designers in analyzing the influences of various shop processing procedures on design. The book also presents excellent possibilities as a text for students in engineering schools. This volume considers methods for removing metal, for forming metal, for working and forging metal and for depositing metal. The discussion is accompanied by 652 illustrations and an index.

Ajax phosphor copper,

like all Ajax alloys, is produced under rigid laboratory standards to constant formulae. In relation to total cost, Ajax alloys give greater performance. No product can do more . . . so protect your quality work with Ajax alloys.

AJAX METAL CO., PHILADELPHIA 23, PA.

ASSOCIATE COMPANIES: AJAX ELECTRIC • AJAX ELECTROTHERMIC CORP. • AJAX ELECTRIC FURNACE • AJAX ENGINEERING

NEW Equipment AND SUPPLIES

For Additional Information on these Items Use Reply Card—Page 215

(1)—Steel Wire Abrasives:

Cleveland Metal Abrasive Co., 887 East 67th St., Cleveland 8 — New abrasives for shot blasting and peening are cut from hard drawn steel wire. Because of their uniform physical properties they are said to be tough and durable, retaining a uniform pellet size over a long period of time, and doing a fast, efficient job of cleaning castings. Other economies are claimed to result from reduced equipment wear and in freight and handling costs. The illustration shows the abrasive in its original state at the left and after 98 hours of blasting service at the right.

For More Details Circle No. 1—Page 215

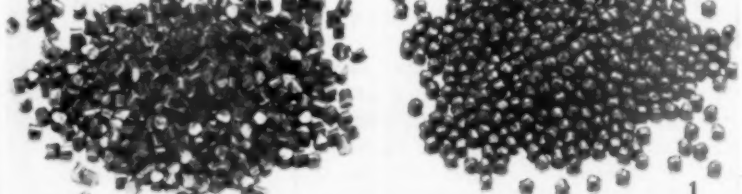
(2)—Die Casting Machine:

Lester-Phoenix Inc., 2659 Church Ave., Cleveland 13—Zinc die casting machine is designed to eliminate, as far as possible, the human element in setup and adjustment. Correct self-alignment is obtained through the following design features: The gooseneck locates itself in two machined slots in the yoke; fixed to the gooseneck is a split bronze bushing which guides the plunger stem, and the head of the plunger is held by a T-slot coupling attached to the plunger cylinder. Plunger cylinder yoke is mounted rigidly on the frame of the machine. Oil lines to and from the plunger cylinder are permanent, rigid pipe lines. The only manual adjustment is with two dog point screws against the bracket, seating the gooseneck firmly against the nozzle. The machine has a zinc shot capacity of 4 to 8 lb, with corresponding casting area of 122 to 230 sq in., and an average capacity of 400 shots per hour.

For More Details Circle No. 2—Page 215

(3) — Sound-proof Booth:

Executone Inc., 415 Lexington Ave., New York 17—Sound-proof booth is designed for use where stations in an intercommunication system are located in high-noise-level areas. By placing the intercom station in the sound booth, a high percentage of the background shop noises are effectively absorbed, and not transmitted to the station in the quiet



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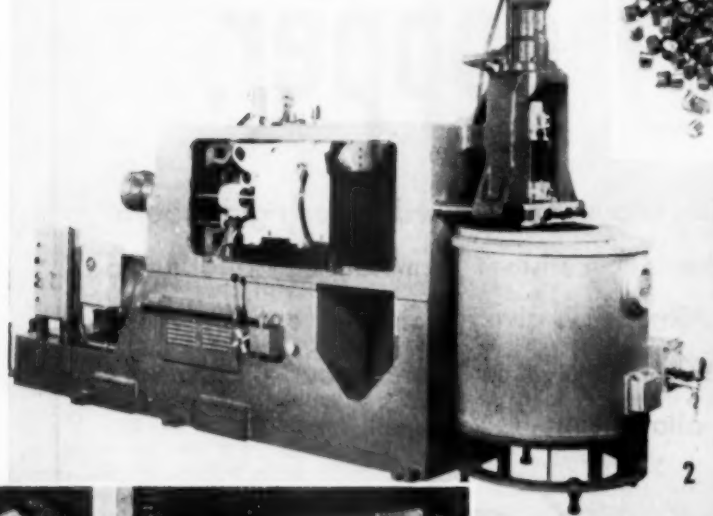

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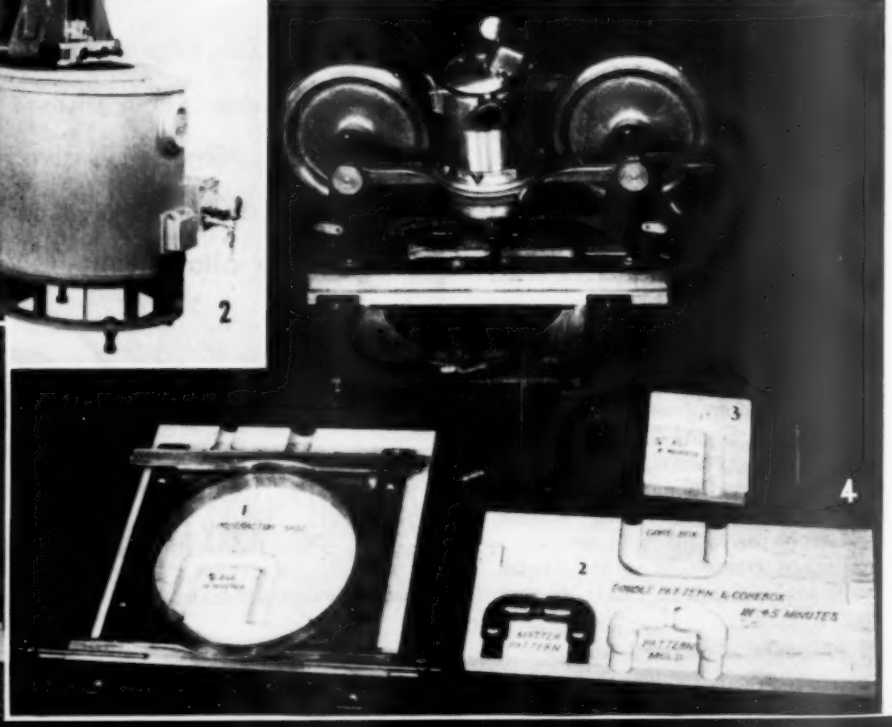


4

area. Thus, two-way conversation between a quiet location and a noisy location can be carried on clearly and intelligibly, it is claimed. This unit also can be used effectively in conjunction with dictating machines, sound system microphones and other makes of intercom systems. Constructed of wood and finished in dark brown, the booth is lined with acoustic insulation board and is 13½-in. square, outside dimensions.

For More Details Circle No. 3—Page 215

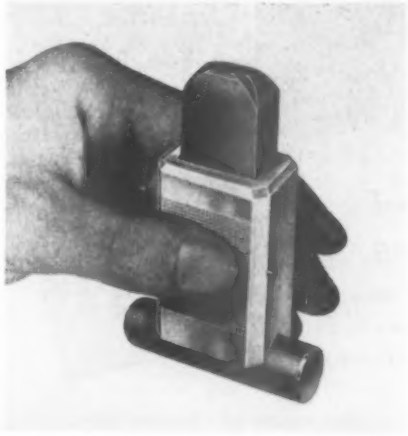
(4) — Patternmaking Machine: Olen L. Miller, Grantsville, Md.—Machine is designed for producing patterns and coreboxes for the manufacture of all kinds of pipe and valve fittings in a fast, efficient manner. The machine also will work out cylindrical and spherical boxes working around ribs, bosses, pads, recesses, arcs and diameters in steps out of solid stock up to 7½-in. diam, and provides both draft and fillets. Fig. 1 shows the protractor base mounted over the center-lines of a corebox. Machine in the background is mounted over this base and the concaved cuts are milled out in any desired angle or circle. Fig. 2 shows the shapes cut into a block of wood for a double pattern mold and corebox for a ¾-in pipe elbow. The master pattern was cast with a low-melting-point alloy, with milling and casting requiring 45 minutes. Fig. 3 shows a plain elbow box produced in 4 minutes. High routing speed employed minimizes subsequent hand sanding.

For More Details Circle No. 4—Page 215

Smoke Density Indicator: Photoswitch Inc., 77 Broadway, Cambridge 42, Mass.—Excess smoke indicator gives a continuous indication to the boiler room of the condition of the gases which are passing through the flue. A tamper-proof sensitivity adjustment on the photoelectric control is set upon installation to compensate for flue dimensions and other variables. As soon as this adjustment has been made, the densimeter indicates and signals conditions of excess air, excess smoke, and efficient combustion at established Ringelmann values.

For More Details Circle No. 5—Page 215

Marking Device: M. E. Cunningham Co., 97 East Carson St., Pittsburgh 3—New marking device has been developed for use with solid steel hand stamps in marking rounds, flats, and other industrial shapes. Holder is cast from aluminum and is designed to facilitate deep, clear and even marking. Holder sides are knurled to assure a good grip, and the holder bottom features a V-slot to permit positive setting. Holder is made in a wide range of sizes to accommodate most standard solid steel hand stamps, and special sized holders can be made to order. For extra large, heavy duty stamping, holders are furnished with metal handles.



For More Details Circle No. 6—Page 215

Pattern Plastic: A. R. D. Corp., 70 Pine St., New York 5—New pattern plastic for use in investment casting is said to have good dimensional stability and can be molded in cast molds at low pressures. It is said that no mold cracks will result in drying and firing because of the controlled expansion properties of the material. Further claims are that no burning need take place within the mold and no ash is left after firing.

For More Details Circle No. 7—Page 215

Melting Pots: Meech Foundry Inc., 9935 Meech Ave., Cleveland 5—Melting pots developed especially for handling nonferrous metals can be furnished in almost any size and shape (round or rectangular) with capacities ranging from 50 to more than 10,000 lb. The pots are cast from a durable, close grained, chromium alloy iron. Features claimed are minimum porosity and scaling, and minimum iron pickup by the melt. Furnished for use in melting, holding, and pouring operations, the new pots

feature gradual tapering wall thickness and side angles of slope to resist swelling and distortion and to provide a greatly increased working life. The five pots shown here are listed as follows: Types M, ME, and S are melting pots; type H is a holding pot, and type T is a melting and pouring pot.

For More Details Circle No. 8—Page 215

Wrenches: Lunkenheimer Co., Beekman & Waverly, Cincinnati 14—Seat ring wrenches for use in valve maintenance work are made of heat treated alloy steel. In use, the union bonnet ring of the valve acts as a guide, bearing against a shoulder on the wrench, assuring firm engagement with the seat ring being removed or put in place. A number of sizes in various models are offered.

For More Details Circle No. 9—Page 215

Steel Alloys: Uniworld Research Corp. of America, 1302 Ontario St., Cleveland 13—Electro-steel alloys are said to have outstanding chemical and physical characteristics, most important of which is high resistance to chemical and acid corrosion. All of the alloys can be melted in the usual electric arc and induction furnaces from readily available raw materials and require little change in melting practice established for high alloy steel. The alloys are said to have good castability, to be nonporous, and to be insensitive as to their carbon content.

For More Details Circle No. 10—Page 215

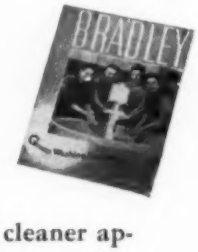
Portable Vibrators: Cleveland Vibrator Co., 2788 Clinton Ave., Cleveland 13—New vibrator assembly incorporates cast steel male and female wedge type mounting brackets for attachment to hopper railroad cars, special hoppers, bins, chutes, flacks, and other bulk material hand-

Bradleys Help Make the Plant a Good Place to Work

An Installation of Bradley Washfountains at the Foundry Division of Erie Malleable Iron Co., Erie, Pa.

ARCHITECT: Johnson & Johnson; *CONTRACTOR:* Sessinghaus & Ostergaard.

Write for Helpful Illustrated Bradley Washroom Catalog



• Adequate facilities for washing are now considered important by foundry managements. Such facilities include sanitary Bradley Washfountains as pictured above.

Foundry workers like others appreciate the value of cleaner appearance when quitting for the day—as indicated by the growing list of foundries that have installed Bradleys during the past 20 years.

Bradleys Save Water and Installation Cost

One hot and one cold water supply and one drain are the only connections required for a Bradley that serves up to 10 men simultaneously. Water used for 10 is but a trifle more than for one person at a conventional wash basin.

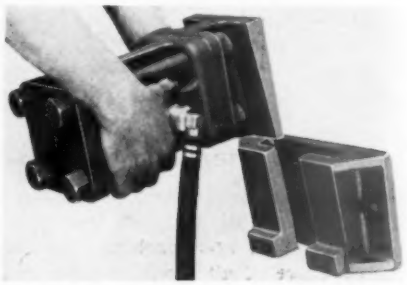
There are no faucets to touch, the spray of water being supplied by the central sprayhead. Other advantages are explained in our Catalog 4701 . . . Why not write for a copy now..... BRADLEY WASHFOUNTAIN CO., 2217 W. Michigan Street, Milwaukee 1, Wisconsin.

A typical group of workers washing up at a Bradley Washfountain. This Bradley will serve up to 10 workers simultaneously.

BRADLEY washfountains

Distributed Through Plumbing Wholesalers

ling equipment. Female brackets can be attached with bolts or by welding, and a single vibrator can be moved from one installation to another to eliminate clogging and to speed material flow. Pneumatic vibrators are available in 3-in. (piston diameter) standard and 3-in. heavy duty long stroke sizes, weighing approximately



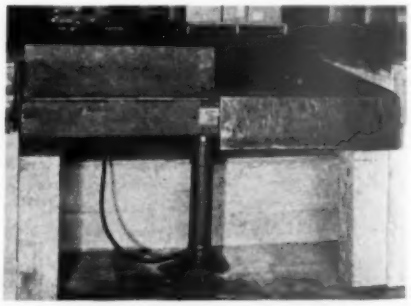
60 and 90 lb, respectively. Mounting brackets weigh 33 lb. Air consumption is 30 and 36 cfm on standard line pressure of 80 psi.

For More Details Circle No. 11—Page 215

Conveyor Belt: Republic Rubber Division, Lee Rubber & Tire Corp., Albert St., Youngstown 1, O.—New type conveyor belt, known as a rubber-glass conveyor belt, for conveying hot materials, features a carcass constructed with multiple plies of glass fabric plus covers specially compounded to resist heat.

For More Details Circle No. 12—Page 215

Dock Leveler: Rowe Methods Inc., 1743 East 25th St., Cleveland 14—Hydraulic-ram operated platform leveling device is designed for installation in most existing docks. Through pushbutton control the platform is easily brought level with the



truck floor to facilitate rolling hand or power trucks between dock and carrier.

For More Details Circle No. 13—Page 215

Battery Charger: Motor Generator Corp., Hobart Square, Troy, O.—Charger for any type of industrial truck battery is designed to charge 200 to 500 amp-hr lead-acid batteries of 12, 15, 16 and 18 cell capacity, and/or 150 to 450 amp-

(*Continued on page* 217)

HELPFUL LITERATURE

50. Blast Cleaning Machine

American Wheelabrator and Equipment Co.—4-page illustrated bulletin No. 144-A on redesigned 48 x 72-in. Wheelabrator Tumblast airless abrasive blast cleaning machine explains construction features and specifications. Machine is designed for handling large heavy blast cleaning jobs and has operating load capacity of 30 cu ft.

51. Floor Resurfacer

Master Builders Co. — 36-page illustrated booklet form MP-4a discusses advantages of Masterplate iron-clad concrete floor having armored surface about ⅛-in. thick composed of metallic aggregate. It is wear-resistant, spark-resistant, static disseminating, nondusting, corrosion-resistant and easily cleaned.

52. Crane Block

American Hoist & Derrick Co.—4-page illustrated catalog No. 300-16 describes Lo-Head crane block designed with short overall length to give crane greater lifting clearance. Block can be obtained in capacities from 10 to 50 tons having one, two or three sheaves ranging in diameter from 18 to 24 in.

53. Graphitized Pig Iron

Tonawanda Iron Div., American Radiator & Standard Sanitary Corp. —12-page illustrated booklet "G-Iron for Sound Castings" explains method of casting pig iron in which graphite is finely divided and evenly dispersed throughout matrix. This graphitized condition of pig iron persists through remelting operation in cupola.

54. Materials Handling

Dependable Mfg. Co.—Group of two folders and four leaflets shows and describes stacking racks, tote boxes, bins and rings; pallets and skids; special made-to-order equipment; corrugated materials handling products; dumping equipment; carts and other equipment for handling materials.

55. Industrial Ovens

Michigan Oven Co.—4-page illustrated bulletin 749 describes standard type ovens for various industrial drying, baking and heat treating processes for operating temperatures up to 1100° F. Covered are cabinet and kiln type ovens, and conveyor ovens of wicket, cross-bar, monorail and flat-deck types.

56. Powered Hand Truck

Bell Aircraft Corp.—4-page illustrated folder "Proven and Improved!" deals with Prime Mover one-man ½-ton carrier which can transport anything anywhere. It is equipped with 3-hp two-cycle engine with large efficient air cleaner, and clutch and gears are entirely enclosed for protection against sand, grit and moisture.

57. Power Hack Saw

Sales Service Machine Tool Co.—2-page illustrated catalog sheet describes Jefferson '601' power hack saw supplied with ¼-hp motor, switch, belt guard and twelve 8-in. saw blades. It cuts iron, steel, brass and aluminum and is suitable for use in machine and welding shops for small capacity sawing operations.

58. Proportioning Oil Burner

Hauck Mfg. Co.—24-page illustrated catalog No. 410 deals with proportioning oil burner for accurate control of furnace temperature and atmosphere during heat processing operations. Unit features single control lever, uniformity of oil-air ratios and flame character from all burners on one furnace, and operation on heavy or light oils.

59. Blowers & Exhausters

Roots-Connersville Blower Corp.—Two illustrated bulletins present comprehensive data on line of blowers and exhausters. Booklet No. 120-B-14 deals with single and multiple-stage centrifugal blowers and exhausters, and No. 22-23-B-13 discusses rotary positive blowers available in wide range of sizes from 5 to 50,000 cfm for pressures up to 15 psig.

60. Production Machines

Production Machine Co.—8-page illustrated booklet entitled "The Production Story" depicts various machines for speeding production that include centerless polishing and buffing, centerless polishing and finishing, surfacing and straight line finishing and horizontal wet surfacer units.

ADDITIONAL INFORMATION?

For additional information on any of the items described under "New Equipment and Supplies", "Trade Publications" or "Helpful Literature" in this issue — simply circle their corresponding item numbers on one of these cards.

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61. Cradle Tongs

Hutchinson Foundry Products—1-page illustrated reprint shows applications of cradle tongs designed to pick up crucible and carry it without pinching or crushing sidewalls. Supplied with reprint are furnace clearance dimensions, crucible sizes and list prices.

62. Inspection Instruments

Buhl Optical Co.—Illustrated data sheets describe S-129 40 to 60-power pocket microscope, S-152 20-power Handi-scope and S-42 Magniprox desk magnifier optical inspection instruments. Specifications, prices and operating instructions are included with description of each instrument.

63. Portable Conveyor

May-Fran Engineering, Inc.—8-page illustrated circular gives data on 8-ft Little Hustler conveyor with welded steel frame and ¼-hp gear head motor. Cleated conveyor is made of 6-ply white cotton belting. Unit has up and down range of 30 in., and belt can be tilted at any angle up to 45 degrees.

64. Materials Handling

Thomas Truck & Caster Co.—64-page illustrated catalog No. 50 lists Job-Suited trucks, casters and wheels for materials handling applications. Included are platform, wagon and two-wheel trucks; superstructures; dollies; trailers; casters and wheels.

65. Contour Saw

DoAll Co.—8-page illustrated catalog 49-302 gives details of Super Zephyr 36-in. contour saw with wide range of speed selections. This band saw with dynamically balanced wheels can be used to cut any material. Uses in variety of industries are depicted and operating features of unit described.

66. Small Machine Tools

Walker-Turner Div., Kearney & Trecker Corp.—16-page illustrated catalog B presents complete specifications, descriptions and current prices of line of small tools for metal and woodworking. Among new models are 12-in. band saw, 6-in. jointer, 8-in. tilting table saw and 9-in. tilting arbor saw.

67. Portable Cranes

Grand Specialties Co.—Vertical file folder contains 4-page insert that lists various portable cranes ranging in capacity from 500 to 6000 lb, winches, hydraulic lifts, box clamps and accessories for lifting and clamping operations. Specifications of equipment are tabulated also.

68. Industrial Ovens

Lanly Co.—16-page illustrated catalog No. 490 deals with various types of industrial ovens that include cabinet, rack or truck, monorail conveyor, laydown conveyor and rack core styles for use in foundries, heat treating operations and ceramic drying.

69. Swing Boom Mobile Crane

Silent Hoist & Crane Co.—4-page illustrated bulletin No. 74 relates how Krane Kar swing boom mobile crane with front-wheel drive and rear-wheel steer can handle all materials handling services.

70. Pneumatic Grinders

Cleco Div., Reed Roller Bit Co.—14-page illustrated bulletin 80A presents line of rotary, cone and vertical grinders; wire brush machines; and file and burr machines. Included is table of general grinder specifications for all models.

71. Materials Handling Trucks

Knickerbocker Co., Truck-man Div.—8-page illustrated bulletin "3 Models Do 4 out of 5 Material Handling Jobs" gives operating and construction features of Truck-man pallet, skid and platform trucks. Gasoline engine powered, trucks can handle from 2000 to 3500 lb and have combination seat and guard for operator.

72. Ladle Equipment

Whiting Corp.—36-page illustrated bulletin FY-163 contains 53 photographs, 25 drawings and 25 specification tables on ladles and accessory equipment to aid iron and steel production men to choose equipment of proper dimensions and capacities.

73. Hand Chain Hoist

Harrington Co.—4-page illustrated bulletin No. P-5 presents construction details of Peerless Packet 1-ton capacity hand chain hoist which weighs only 53 lb. It requires 56-lb pull to lift full capacity and 42 lb for ½-ton.

74. Loading Dock Lifts

Wayne Pump Co.—4-page forms 818-R, 826 and 822 describe tilting loading dock lifts and ramps. Hydraulic units are powered by air or electric pumping unit and have standard capacity of 20,000 lb.

75. Wire Rope Slings

John A. Roebling's Sons Co.—72-page illustrated catalog A-900 presents information on wire rope, grommet and Flatweave slings as well as on wire rope fittings. Many different designs are listed, constructions discussed and loads classified.

76. Materials Handling Units

Sage Equipment Co.—4-page illustrated pamphlet "Sage, the Finest in Materials Handling Equipment" shows and describes gravity wheel and roller, live roller, slat or chain and floor-to-floor conveyors; portable belt boosters; sorting tables; belt conveyor tables for assembly work; dumb waiters and hand trucks.

77. Core Box Blow Buttons

Martin Engineering Co.—4-page pocket-size folder entitled "Pullinsert" describes blastproof core box blow buttons that stop abrasion under blowholes. Installation instructions and dimensions are given also.

1	21	41	61	81	101
2	22	42	62	82	102
3	23	43	63	83	103
4	24	44	64	84	104
5	25	45	65	85	105
6	26	46	66	86	106
7	27	47	67	87	107
8	28	48	68	88	108
9	29	49	69	89	109
10	30	50	70	90	110
11	31	51	71	91	111
12	32	52	72	92	112
13	33	53	73	93	113
14	34	54	74	94	114
15	35	55	75	95	115
16	36	56	76	96	116
17	37	57	77	97	117
18	38	58	78	98	118
19	39	59	79	99	119
20	40	60	80	100	120

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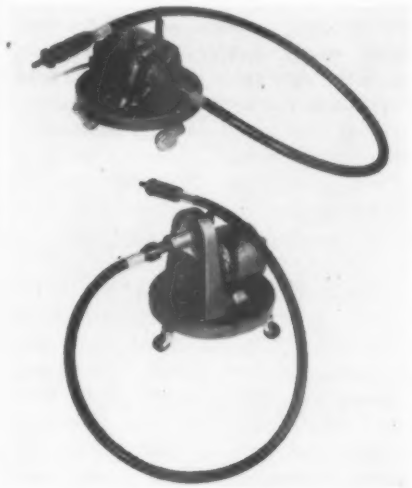
(*Continued from page* 214)

hr nickel-iron batteries of 20, 24 and 30 cell capacity. This unit consists of a separately excited motor-generator set with a no-load voltage control of 30 to 60 v, plus a voltage-drop control. The no-load voltage control is calibrated for the different cell combinations of the batteries to be charged. At the completion of the charge, the charger automatically shuts down and disconnects the battery.

For More Details Circle No. 14—Page 215

Power Units: Stow Mfg. Co. 443 State St., Binghamton, N. Y.—Two new portable power units can be used for polishing, routing, brushing, grinding, buffing, drilling, filing, sanding, and other jobs. The machine shown at the top of the illustration delivers ¼-hp at 1750 rpm through



a 5-ft flexible shaft. Motor operates on 110 v, 60 c, single-phase alternating current. Both 1/3 and ½-hp units also are available. The machine at the bottom of the illustration offers three speed variation—1000, 1750 and 3000 rpm. These velocities are obtained by altering the plug-in position of the flexible drive shaft.

For More Details Circle No. 15—Page 215

Nonskid Floor Plate: Alan Wood Steel Co., Conshohocken, Pa., Dept. W-40—Abrasive rolled steel plate nonskid flooring is intended for use on industrial floors, loading platforms and ramps, walkways, building entrances, and for trench and hatch covers—in every application where there is danger of men slipping and injuring themselves. The material is said never to lose its nonslip characteristic because as the surface wears, new abrasive particles are constantly exposed. It is made by rolling abrasive grain, the same type used in grinding wheels, into the upper portion of steel floor plate. Plates are

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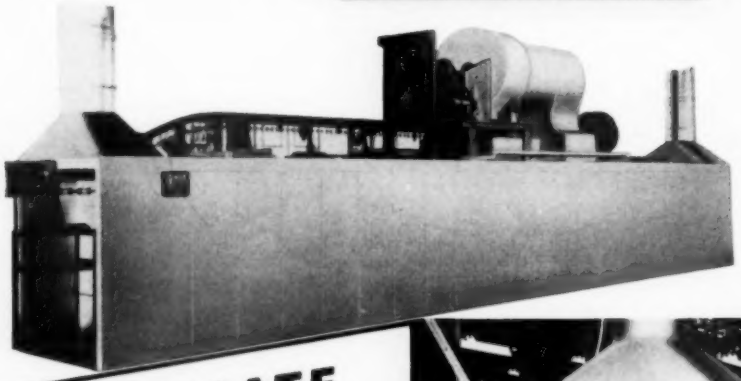

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(Above) Overall view of LANLY Gas Fired Continuous Oven. (Lower Illustration) Close-up of entrance end showing carriers and fume sealing vestibule.

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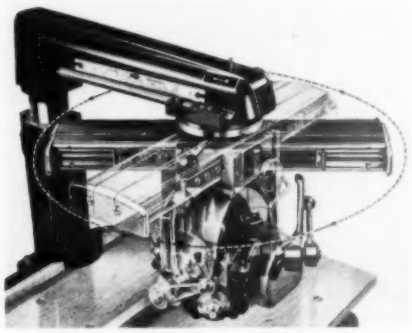
available in thicknesses from ⅛ to ⅜-in., and in widths up to 60 in. by 144 in. long.

For More Details Circle No. 16—Page 215

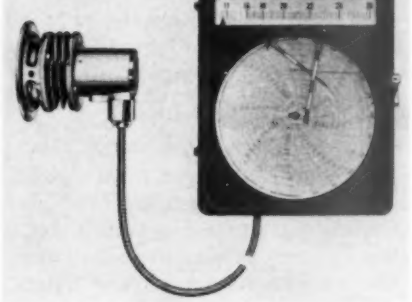
Woodworking Machines: Power Tool Division, Rockwell Mfg. Co., 600 East Vienna Ave., Milwaukee 1—Engineering design utilizes two instead of the usual three cir-



cular movements found in radial type woodworking machines. The unit works at a center pivot position above the saw table, and it is claimed that the motor power unit may be located at any position, even vertically, above the working table. Any kind of rotary cutting tool can be attached to the motor spindle.

For More Details Circle No. 17—Page 215

Radiation Pyrometer: Bristol Co., Waterbury 20, Conn.—New radiation pyrometer is designed for indicating, recording or controlling temperatures up to 4000° F in furnaces and kilns. Unit is mounted outside the furnace and picks up radiant energy emitted from the surface of the object under measurement. Thus, it is claimed, actual surface temperature measurements of the work are obtained, rather than



furnace atmosphere temperatures. The instrument is said to produce a 99 per cent response to a temperature change within one second.

For More Details Circle No. 18—Page 215

Heat Treat Furnace: Surface Combustion Corp., 2375 Dorr St., P.O. Box 907, Toledo 1, O.—Batch

type radiant tube fired furnace is designed for clean hardening, gas carburizing, dry cyaniding and other controlled atmosphere heat treatments. The furnace is available with built-in RX atmosphere generator to provide for gas carburizing, homogeneous carburizing, dry (gas) cyaniding and carbon restoration, clean hardening and general heat treating. Work is carried in and out of the furnace on four trays which are moved by alloy screws. Furnace has a maximum gross charge capacity up to 2500 lb, depending upon the type of work to be processed.

For More Details Circle No. 19—Page 215

Coated Work Gloves: Surety Rubber Co., 242 Hall Ave., Carrollton, O.—Wear-resistant nonslip finish for fabric work gloves is designed to give effective gripping action in liquids, including lubricants, yet not to injure metals or machinery. The coating is said not to crack or peel and to have high resist-

ance to chemicals. The gloves are available in knit wrist, band top, safety cuff, and gauntlet types—most styles with or without ventilated back, as desired.

For More Details Circle No. 20—Page 215

Shot and Grit: Steelblast Abrasives Co., 6536 Carnegie Ave., Cleveland 3 — Two new company products—malleablized shot and grit for general abrasive blast cleaning and steel shot consisting of cut steel wire with hardness of 46-52 Rockwell and 270,000-300,000 psi tensile for shot peening—are said to have a number of desirable characteristics including long service and low wear on equipment.

For More Details Circle No. 21—Page 215

Paint: Stonhard Co., 500 Stonhard Bldg., Dept. TF, 1306 Spring Garden St., Philadelphia 23—Plastic formula paint is said to provide an acid-resisting coating that can be applied to all maintenance areas or

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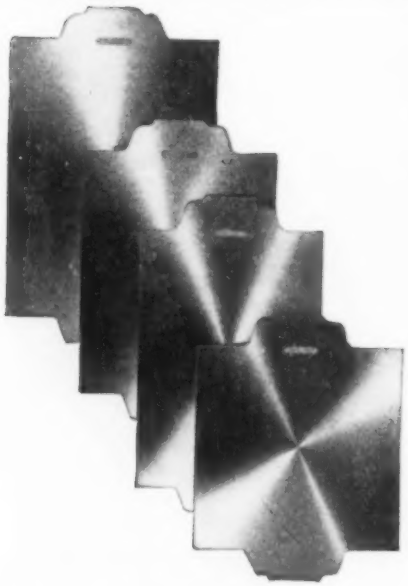

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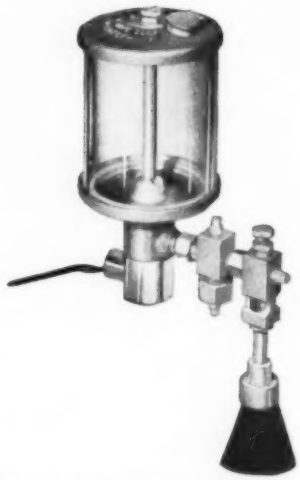
wherever corrosion is a special problem—on concrete floors, walls, ceilings, structural steel, tanks, pipes, vats, ducts, machinery and equipment. It may be brushed or sprayed and is said to dry in ½ to 1 hr under ordinary temperatures. It is available in five colors as well as in black, white, transparent, and aluminum.

For More Details Circle No. 22—Page 215

Chain Oiler: Oil-Rite Corp., 3487 South Thirteenth St., Milwaukee 15—Solenoid-operated chain oiler for automatically lubricating conveyor chains is designed to provide positive lubrication whenever the chain is running. Lubricant is fed by gravity from a reservoir through a solenoid-operated valve and a sight feed valve to a brush which rides the chain, spreading and wiping the desired amount of oil evenly on the chain. The stainless steel solenoid valve is Underwriter's approved, and can be



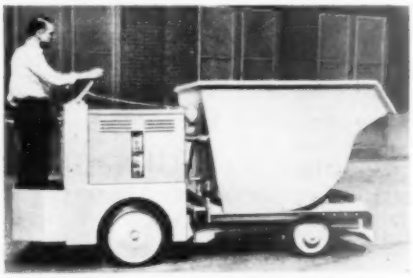
supplied in all commercial voltages and frequencies including direct current. Manually operated chain oilers also can be furnished, having a needle valve instead of a solenoid valve actuated by a toggle shut-off on top of the oiler.

For More Details Circle No. 23—Page 215

Cold Solder: Alvin Products Inc., 20-22 Houghton St., Worcester 4, Mass.—Cold solder may be applied with a putty knife or rubber squeegee to blow holes, sand holes, surface blemishes and rough or porous places in metal castings and other metal surfaces. The material is said to harden in a short time to a strong permanent metal bond which can be ground and sanded to a feather edge and painted without danger of bubbling, it is claimed. Additional claims are that the material may be thinned with any regular lacquer thinner and brush painted or sprayed to give a waterproof, rustproof hard metal finish that will not shrink or crack.

For More Details Circle No. 24—Page 215

Dump Truck: Mercury Mfg. Co., 4036 South Halsted St., Chicago 9—New battery-powered electric end dump burden carrier truck is designed for bulk handling. The body dumps by gravity when released by a lever convenient to the operator's position. Body is said to dump cleanly and return to lever latched position when emptied. Body capacity is 1½ cu yd, and the truck load capacity is



rated at 6000 lb. Design features include four-wheel lever type steering, double reduction drive axle, semi-elliptic spring suspension, and mechanical contactor travel controller.

For More Details Circle No. 25—Page 215

Combustion Control: Combustion Control Corp., 77 Broadway, Cambridge 42, Mass.—Programming control is designed to provide automatic starting and programming for commercial and industrial oil and gas burning equipment. Unit automatically starts the burner in operation and programs the sequence of fuel valve opening, post-ignition timing, priming, and scavenging. It is used with electronic flame rod or photoelectric scanner for continuously safeguarding gas or oil burner installations, respectively, against the danger of flame failure.

For More Details Circle No. 26—Page 215

Grinding Tool: Dumore Co., 1225 Fourteenth St., Racine, Wis.—Handgrinder for light industrial applications is powered by a 1/40-hp

motor which runs on 115 v ac or dc. It is designed for light and intermittent bench and finishing work, touching up work on dies and molds, chain saw sharpening, on-the-job tool sharpening, and similar jobs. The tool weighs 12.5 oz and is constructed

of shock-proof plastic. It features pushbutton lock for quick, no-wrench tool change; handy thumb switch for convenient control, and engineered shape and balance for increased ease of handling and reduced operator fatigue.

For More Details Circle No. 27—Page 215

Plastic Floor Material: Monroe Co., Dept. 88—No. 2, 10703 Quebec Ave., Cleveland 6—Plastic type floor material for patching or completely resurfacing wood or concrete floors is applied with a tamper or by rolling. Since the material is set by compression, rather than by water evaporation, the more traffic that flows over it, the smoother and harder and better the floor becomes, it is claimed. It also is said that the material can be applied in a few minutes and will sustain a load one minute after applied.

For More Details Circle No. 28—Page 215

Pyrometer: Thermo Electric Co., 22-02 Raphael St., Fair Lawn, N. J.—Thermo electric multipoint

pyrometer is designed for indicating temperatures from one to six thermocouple locations at operating ranges from 75 to 400, 1000, 1600 and 2300° F, and minus 300 to plus 300° F, or equivalent centigrade scales. The unit automatically is compensated for cold junction temperature changes and instrument temperature resistance coefficient.

For More Details Circle No. 29—Page 215

Marking Stamps: Acme Marking Equipment Co., 8030 Lyndon, Detroit 21—Fractional figure metal marking stamps are made of high-grade tool steel, blued for rust prevention, with the striking head tempered by a special process that is said to prevent chipping or mushrooming. The stamps are packed in sets of nine pieces each, reading: ⅛, ¼, ⅜, ½, ⅝, ¾, ⅞, 1, and a separate inches sign. Each stamp is marked on the front with the character designation, which also shows

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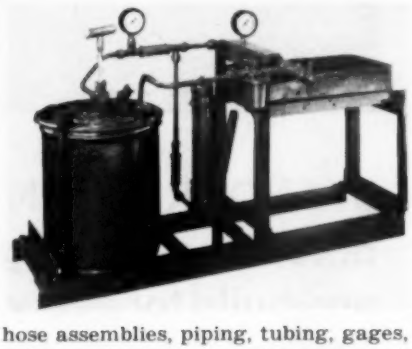
the correct position for stamping. Individual stamps are available. The set of nine stamps is packed in a hardwood case, with individual compartments for each stamp.

For More Details Circle No. 30—Page 215

Portable Dust Collector: Kirk & Blum Mfg. Co., 2888 Spring Grove, Cincinnati 25 — Heavy-duty portable dust collector is available in three models—450, 900 and 1800 cfm at high velocity. Collectors handle dust from grinding, burring, and polishing metal working machines and similar dust sources. Each unit consists of motor, exhauster, centrifugal precleaner and steel wool filter aftercleaner. The units are fireproof. Dust receptacles are gasketed, sliding drawers, secured with a hand wheel to insure a leak-proof seal. Cleaned air may be released inside the building or vented to the outside.

For More Details Circle No. 31—Page 215

Hydraulic Test Fixture: J. N. Fauver Co., 49 West Hancock, Detroit 1 — Fixture is designed for mounting on a bench for checking



hose assemblies, piping, tubing, gages, valves, cylinders, etc. The equipment consists of a low-pressure pump for quick filling of equipment being tested from a reservoir that holds approximately 3 gal. Test pressure can be built up to 5000 psi; higher pressure units are available if required.

For More Details Circle No. 32—Page 215

Paint Supply Pump: Gray Co., 49 Eleventh Ave. N.E., Minneapolis 13—New type paint supply pump and agitator delivers paint directly from original containers at low fluid pressures. A positive displacement, immersion type gear pump, driven by a rotary air motor, delivers paint directly to the spray head, or pumps it through circulating supply lines. Since no air pressure is exerted upon the paint itself, aeration is reduced to a negligible amount. An agitator at the base of the pump keeps paint thoroughly mixed, it is claimed. Unit is available in two sizes: A portable, 5-gal model and a 55-gal model.

For More Details Circle No. 33—Page 215

SOLIDIFICATION of Molten Metal

(*Continued from page 97*)

liquid metal in the section itself to fill the interstices of the dendrites until finally, unless the compensating metal can reach the position of the unfilled dendrite interstices, they remain as voids in the casting. This is easily confirmed by an examination of shrinkage cavities, particularly those occurring at the center line.

Whether or not the compensating metal from the riser or adjacent section can reach these interstices depends on its viscosity or fluidity. This, in turn, is dependent primarily on temperature for a given composition and also somewhat on the surface tension of the compensating metal. If solidification should proceed to the point where there are interlocking dendrites at the center line of a given section and the compensating metal has a viscosity that is too low, it will be unable to penetrate and fill the voids in the interstices of the protruding and interlocking dendrites. Likewise, the metal will fail to penetrate to the interstices if the particular composition at the proper viscosity possesses sufficient surface tension to resist the forces tending to force it into position.

Susceptible to Weakness

From the above, it is evident that certain compositions are more susceptible to center-line weakness than others and this is the case found in practice. It also should be obvious that, from the design standpoint, sections of castings should be so proportioned that a point near the riser should not solidify before a point lower in the section, thus shutting off the supply of compensating metal.

It is well known that many alloys are particularly susceptible to the solution of gases when these alloys are in the liquid form and at high temperature. Several investigations[5, 6] have shown that there is a sudden decrease in solubility at the solidification temperature. If such gases exist in a metal, even though the metal has been properly refined to eliminate them, they will be released at high pressure. Under the temperature conditions existing in most metals at the solidification point, even an extremely small amount of gas would occupy a very large volume.

So long as the metal in the riser is sufficiently liquid to allow the released gases to bubble through it to the surface and escape, no difficulty is encountered. However, as the dendrites of the solidifying metal ap-

proach the center line of a section, the compensating metal also is decreasing in temperature and decreasing in viscosity, thereby offering greater and greater resistance to the passage of any gas that may be evolved from the metal. If the viscosity and/or surface tension of the compensating metal are too great to allow the released gas to escape to the surface, it will remain in position and the dendrite interstices will not be filled, thereby creating a cavity or unsoundness. As the temperature of the mass decreases, the gas pressure and volume will decrease but the void left by the gas will be of a size occupied by the gas at its original pressure and volume.

Mechanism of Feeding—The writer has discussed the forces which act to prevent proper feeding of casting sections. Acting against these previously mentioned forces are at least three which tend to force the compensating metal from the riser or adjacent section into the voids created by the decrease in volume which occurs during solidification.[7]

The first is the vacuum effect. When a unit portion of liquid metal solidifies, it occupies less volume than in the liquid state. If this solidified unit is surrounded by liquid metal, a vacuum will be created, due to the change in volume, and the liquid metal will be sucked into position to compensate for the difference in volume.

The second force acting on the liquid compensating metal is the weight of the liquid metal column. This is similar to the head in hydraulics and often is termed the ferrostatic pressure, regardless of the metal being cast. It is primarily a static head as the velocity is so small as to be negligible.

The third force is atmospheric pressure. Hence the total force acting to force the compensating metal into voids created by the volume change consists of the atmospheric pressure plus the liquid head less the pressure of the vacuum. Atmospheric pressure can be obtained from any barometer. Where the density of the liquid metal and the feeding area are known, the static head can be calculated. The pressure of the vacuum is an unknown quantity since it is practically impossible to determine it.

Effect of Solidification on Structure—As mentioned previously, solidification in a given casting section proceeds rapidly at the mold metal interface and more slowly toward the center, due primarily to specific heat changes and to thickness of the solidified portion.

As a result of this variation in

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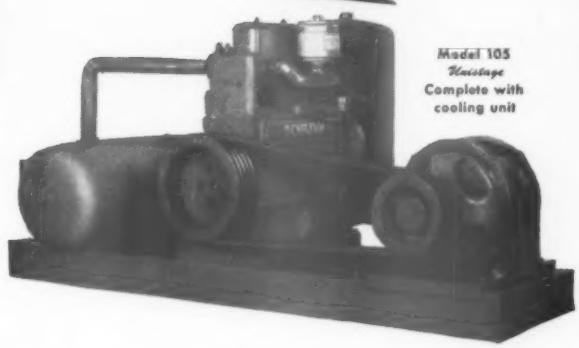

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Today, the more progressive foundrymen all over the U. S. obtain better copper and copper alloy castings by adding Lithium in the new, convenient cartridge form.

This eliminates the disadvantages common to other methods of adding Lithium. Moreover, it costs less and gives more satisfactory results.

These cartridges — metallic Lithium hermetically-sealed in copper tubing — come in three convenient sizes: 2.25 grams, 4.50 grams and 9.0 grams.

By using a suitable combination of these cartridges, any desired amount of Lithium can be introduced into the molten metal.

Added to copper base alloys in this manner, Lithium remarkably increases tensile strength as well as elongation. And, in most cases, there is a marked reduction in grain size.

As a degasifier of Nickel Bronze, Lithium cartridges prove highly satisfactory. A dense, fine grained metal is obtained.

In high conductivity castings, Lithium cartridges produce an electrical conductivity in the "as cast" condition from 95 to 98% I. A. C. S. Specific gravities of 8.90 have been obtained, indicating absence of porosity.

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solidification rate, grain size, due to the large number of neuclei at the mold-metal interface and hence rapid change in direction of dendritic growth, will be small. As solidification proceeds, the temperature difference between the liquid and solid metal decreases, resulting in less neuclei. The rate of heat dissipation tends to decrease and the dendrites growing from the less numerous neuclei tend to become larger, as does also the grain size. Since, in general, small grain-size materials are stronger than those containing large grains, there is a variation in properties across the section. This is true regardless of the metal cast and is due primarily to the solidification mechanism.

Effect of Solidification on Design—From the foregoing discussion, it is evident that an extremely important consideration in casting design is the position the prospective part will occupy in the mold. If so positioned that it cannot be fed properly by adequate risers correctly placed, the results will be doubtful.

The ideal casting design would be one which begins to solidify from the bottom upward and from the mold-metal interface inward at such a rate that compensating metal from the riser, located at the top of the mold, would continually feed to the sections of the design until solidification is complete. Such an ideal casting would be wedge-shaped with a riser at the heavy section of the wedge. This statement concerning solidification is termed in the metal casting industry the principle of controlled, directional solidification and was originated by the late George Batty.[8]

Naturally, the ideal design can seldom be achieved but it can be approached by designing sections as uniform in cross section as possible, with those sections running from the top to the bottom of the mold having a slight taper.

It also should be obvious from the discussion of solidification that castings should be so designed that thin sections, which solidify relatively rapidly, should not be placed above heavier sections. Such a condition cuts off the feed metal from the larger section beneath.

The use of excessively large fillets has received comment. However, from the solidification standpoint, their use increases the section size at the joint, hence slows the time for solidification, and if they are not properly fed, causes a void. Fillets usually are designed with radii of from 80 to 120 per cent of the radius of the joining sections.

It can be seen that if two sections cross and are filleted at the junction, the cross-sectional area at the fillets will be considerably greater than that of the individual members. To minimize the increase in section size, crossing members should be staggered. Use of excessively large fillets to increase section modulus may defeat its own purpose, as previously noted.

Reinforcing ribs often are necessary or desirable. In such cases, the ribs should be slightly wedge shaped, to promote controlled-directional solidification, and staggered to minimize section size increase at the junctions with cross members.

The above are merely a few precautions to be taken in the design of castings. In the book[9] *"Designing for Quality Production,"* the writer contributed the chapter on sand castings. In this chapter he suggests 20 precautions to be observed in designing castings to assure the best product. For further information on this subject, the writer suggests this book. It will be noted that many of the precautions listed for sand castings are equally applicable to other casting methods.

Effect of Shrinkage on Properties—Two general types of shrinkage appear in castings: (1) Centerline and (2) distributed. If shrinkage at the center-line of a section occurred as a smooth hole of equal radius from the center-line, no harm would be done. However, this is not the case and the irregular surface plus the incipient cracks along the grain boundaries reduce the strength. It is the writer's opinion that such centerline weakness, if not too great, usually is not too important so far as the strength of a given section is concerned when the section is in either pure tension or compression. Even though the functioning cross-sectional area of the member may be reduced by the shrinkage, the design factor of safety, usually five or more, would offset the effect of the defect.

Casting members subjected to pure compressive or tensile stress are rare. More often, such members are subjected to vibratory stresses. If such stresses exist, the center-line shrinkage is a definite danger. It has been shown that fatigue cracks start at the poorly joined grains at the shrinkage cavity and may progress to failure. It seems probable to the writer that such defects are more effective in reducing strength in the so-called single-phase alloys, such as steel, brass and bronze, than in the two-phase alloys such as cast iron[10]. These latter are less sensitive to notches and surface discontinuities

than are the single phase alloys.

Shrinkage often is distributed throughout a section as microshrinkage. This type has the same general effect as center-line shrinkage in lowering strength properties due to decrease in section. The effect on fatigue may be even greater because of the greater opportunity for fatigue cracks to develop. The writer has never seen any data on fatigue tests of such metal but is merely hazarding a guess.

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Community Relations Report Issued

A booklet entitled "Community Relations: Getting Acquainted with the Community" has been published recently by the Metropolitan Life Insurance Co. A survey of 85 companies whose relationships with the citizens of their communities are known to be excellent is the basis of this 43-page report. It is devoted to a study of the philosophy of community relations and methods of getting better acquainted with the community and its citizens. Copies may be obtained from the Policyholders Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York 10.

Electrical Contacts

The 1948 and fifth Supplement to the *Bibliography and Abstracts on Electrical Contacts* just has been published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3. Containing 24 pages the booklet includes a number of replacements and new references for the period 1940 through 1946, and much new material for 1947 and 1948. Price is 75 cents. Bibliography with all supplements is $6.75.

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THE Cupola

(*Continued from page 77*)

extreme importance, the gases in intimate contact with the iron under all conditions.

Obviously, we are interested not just in having the system work but rather in having it operate under a balanced condition and in accordance with some predetermined requirements. Consequently, this directs our attention to the specific and limiting dimensions of each operation.

We can now consider how the five principal factors previously mentioned influence the process and, additionally, the integration of them for optimum results. It must be kept in mind that no single factor under all conditions is responsible for good or bad operation because each one of the factors is subject to violent changes, and only at some particular moment be discordant in the process, or, as frequently happens, two or more of the factors may be responsible.

In a system of five variables it is evident that only when a reasonably close balance is effected between them all will we have harmony, and also that because of economic pressure we must, under most conditions, content ourselves with a practical adjustment rather than strive for perfection in the form of absolute control of each factor.

Fortunately it is possible to establish good control without undue expenditure, but only if we know the limiting or controlling features of each factor. These we will attempt to point out in the following sections.

Because of the general nature of this presentation no attempt will be made to set up specifications for any particular operation, but the basic relationships will be emphasized and must be considered in operating any cupola.

The Cupola—The two principal dimensions of the cupola are its diameter and operating height (charging door to tuyeres). The diameter determines the melting capacity per hour and the height effects its thermal efficiency.

Generally the shaft is straight lined but it has been found advisable to construct a throat or protective ledge over the tuyeres to free them from slag. This ledge should extend 3 to 4 in. beyond the normal lining and extend upward 12 to 20 in., tapering gradually to the regular lining.

In most instances the melting zone is the only area requiring constant repairs. In some cases for long heats this area is completely replaced with new brick or sandstone, but in most instances this area is only patched.

Volumes can be written on how not to patch a cupola, because the general practice is most abusive and will account for a large proportion of the refractory costs involved. Additionally the work is done by an inexperienced crew early in the morning or at night without proper supervision. Frequently whole sections of the patch are noted to have slipped from position and the brick seen sliding past the tuyeres. The "mud" is so wet when applied that the entire surface cracks when dried. The "mud" also may be straight clay because its plasticity makes it more easily worked.

A little study and supervision will produce amazing results both in the form of reduced repair costs and in better iron. Poor patching invariably results in poor air distribution and consequently poor combustion.

Cites Proper Procedure

The recommendations are to repair the cupola with a minimum of "mud," tight joints, and to conform to the original lines so far as possible. Keep the upper tuyere plates in good condition and properly positioned. The "mud" or cement should be of proper silica and clay composition, and only a minimum amount of water used to produce a neutral mix so that it will not check on drying.

Frequently when the cupola is eroding badly the refractories used may be held responsible. This may or may not be the case. In many instances the underlying cause could be one of several conditions. Poor limestone, or distribution of the stone, or an excessive quantity, or an improper distribution of air through the tuyeres all can have this effect.

The well should be designed for the quantity of iron being handled. If greater capacity is needed do not take the volume from the tuyeres or crowd the slag hole upward as is frequently done—but move the tuyeres up for the distance required

With rear slagging allow a minimum of 2 to 4 in. distance between the tuyeres and the top of the slag hole. A lesser distance causes considerable trouble from slag at the tuyeres.

Front slagging in most instances is preferable to rear slagging and really operates satisfactorily over a wide range of melting rates without changes in construction.

The tap hole should, of course, be adjusted in size to the draw required.

Many cupolas are out of balance in this respect.

Sand for the bottom should not be too wet or packed too hard. This is a must, and also is not as carefully watched as it should be.

As we all know, the tuyeres of the cupola are the most controversial subject of the whole system, and generally without justification. The tuyeres are simply one part of the entire air system and their specific function is to provide for equal distribution of air around the circumference of the cupola, provided the rest of the system will permit this to take place.

The tuyere area in most cases can be restricted to the range of 16 to 28 per cent of the cupola cross section, this area diminishing as the cupola area increases. The box type tuyere is preferred. A single row of tuyeres is advocated, and the many claims advanced for special tuyeres cannot be substantiated because of the many other factors which exert far greater influence. The simplest design which will furnish the proper area and permit good repairs will adequately serve the purpose.

Charging Equipment—Production demands and high labor cost, of course, have been responsible for the introduction of mechanical charging equipment. It has adequately served its purpose in this respect, yet we must recognize that simultaneously it has, in many instances, created additional problems in the matter of technical control in the process.

Few mechanical chargers will do as good a job as reliable hand charging, because of the indiscriminate positioning of the material generally resulting from bucket charging.

To illustrate, the low cost of a skip charger recommends itself for certain installations, yet the sloping charge resulting causes a poor distribution of the coke and its effect is always readily noted.

Another example is the single door drop bottom bucket, which allows the charge to fall as a unit with a terrific impact on the other charges already in the cupola. The coke is crushed and the charges tightened up to a considerable extent. Invariably cupolas so charged require higher operating blower pressures.

One of the difficulties of most bucket charging is the haphazardness with which the materials are charged. Frequently the coke is added to the same bucket carrying the metal and when charged the two are indiscriminately mixed. Additionally greater coke breakage results.

Mechanical charging unquestionably is a necessary adjunct to the

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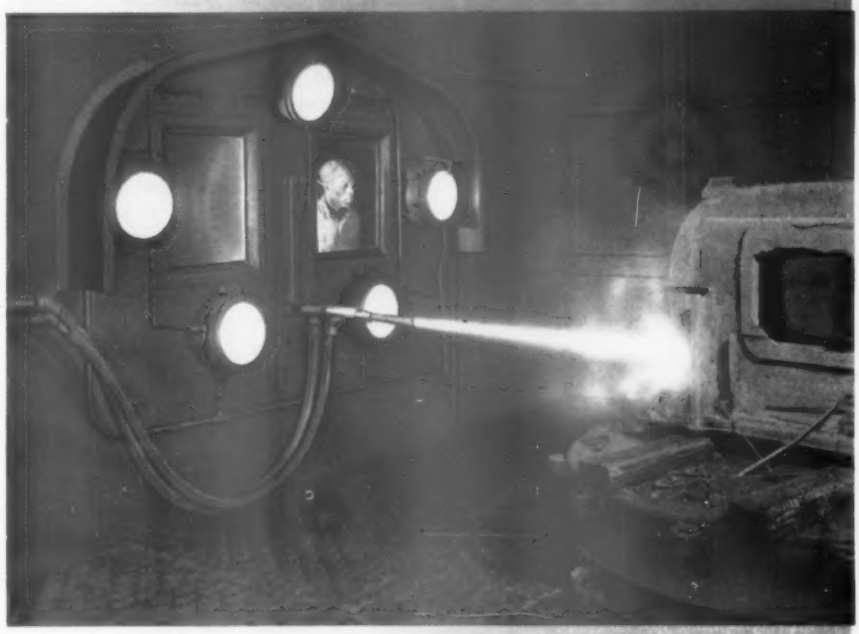

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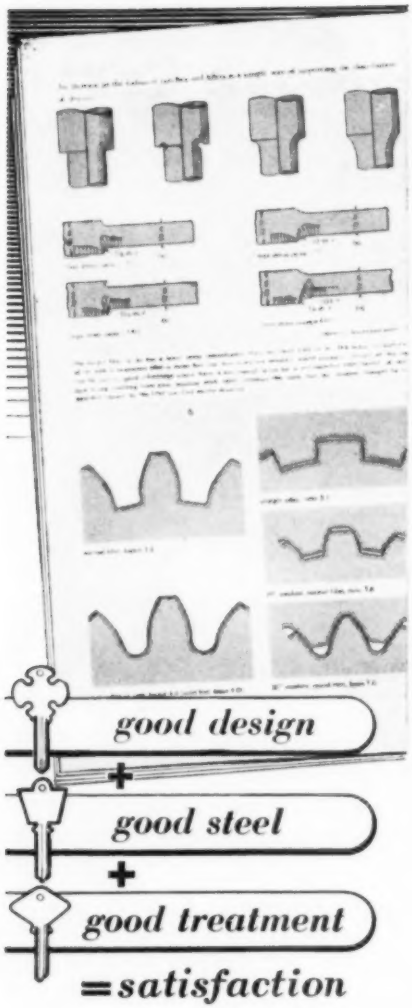

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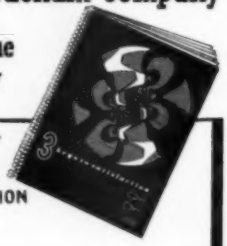

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modern foundry handling any sizable tonnage, but the type of equipment chosen should be carefully considered in connection with its effect on the process itself.

Raw Metal—With a return of adequate pig iron and better scrap many of the serious metal composition problems of recent years have disappeared, but the experience during the shortage years should bear good fruit.

One of the most important single factors for good cupola operation is the maintenance of a proper size distribution of all material throughout the entire cupola column, for without this we cannot expect proper distribution of the gases which affect both the heat transfer and the metal chemistry. It is obvious in this respect that the metal must exert the greatest influence because of its proportion in the charge.

Balancing the charge chemically is only part of the job, for if the material is not properly sized also, we delude ourselves in thinking that the cupola will melt it uniformly to produce the final analysis we want.

Although the cupola has an amazing capacity for digesting almost any material charged, we should not conclude that the patient did not become sick in so doing. Our concern must be directed to how capably the material is melted and blended.

Excessive quantities of iron with sections either too thin or too thick are undesirable (Figs. 1 and 2). If too thin it may carry heavy quantities of rust, throwing a heavier than normal burden on the slag, or it may become so compacted that the gas flow is seriously impeded. Additionally it will melt in advance of the rest of the stock and disturb the calculated composition. Conversely the thick material will be slow in melting and again upset the composition. Bulky material such as motor blocks reduce the amount of material which can be charged and create extremely large voids.

When steel is used in the charge it should be carefully apportioned and the steel content of the cast scrap should also be considered. The lower carbon content of this material will, of course, seriously affect the carbon in the final iron.

Burned iron such as grate bars, firebowls, etc. should be used only when the metal characteristics are unimportant. This material cannot be reduced properly in the cupola and if left in the charge, it will produce hard spots in the castings.

Fine material or poorly bonded briquettes (Fig. 3) can be quite injurious to the metal; both melt very quickly and are subject to extreme oxidation resulting in high losses in silicon and carbon, and producing a metal which sets up too fast to mold properly. Extreme care must be used if these materials are charged in any quantity.

The foregoing material can, of course, be used in reasonable quantities, but if our interest is good commercial iron of consistent characteristics we must carefully control these factors to make it possible. Frequently losses in castings and production are far greater than the initial savings between such scrap and good melting stock.

Slagging—Except for extremely short heats all cupolas should be slagged. This is accomplished by rear slagging through a separate rear hole or by the front slagger where the metal and iron are discharged together and separated in a trough by means of a dam. Where possible the latter is preferred.

To determine the proper amount of flux required it is necessary to consider the amount of ash in the coke, the rust on the metal charged, the sand adhering to shop scrap and the patching practice employed.

The function of the slag is to free the metal of all extraneous material which would be injurious to the castings. Unfortunately, very little real work has been done on this subject so that each shop has developed its own particular methods.

In many instances the slag has been blamed for excessive erosion of the lining, and while it is the actual medium causing the solution of the refractory, some other mechanical reason may have forced this action.

With general scrap (no excessive burned iron) and a normal coke a good flux would be 3 to 4 per cent of the metal charge, i.e. for a 1-ton charge 60 to 80 lb of good limestone. Spar, of course, can be added if desired to increase the fluidity or soda ash for better sulphur removal. No more flux should be used than is actually required, for it can increase lining erosion and refractory costs.

Fuel—It is well to recognize that the function of the fuel is two-fold; First to furnish the heat for melting the stock and secondly to preserve the carbon present or, in many instances, to increase the carbon through absorption. This latter function is frequently lost sight of in the operating technique employed.

Again our recent experience with many poor cokes should remain with us as a valuable tool in interpreting how to extract the greatest benefits from any coke used. Logically the

foundry industry will seek the best cokes available but it must be remembered that foundry coke is produced only in limited quantities by a few firms as the market dictates, and secondly these firms are widely scattered across the nation, forcing each foundry to seek the closest source.

Cokes from different sources can and do vary in their operating characteristics due to the various coals used and the mode of production and sizing. Frequently different cokes can be used interchangeably, but this is the exception rather than the rule.

Coke has been a commodity very difficult to index properly in terms of universal understanding, and for this reason considerable mystery and misinformation surrounds it.

In attempting to set up specifications for any commodity we can err in two directions. We can have them completely restrictive by overemphasis of many factors or worthless because of insufficient scope. Both exist today. There are, however, certain inherent features which are of prime importance in identifying a coke and these only will be considered in this discussion.

Chemical and Physical Tests

In the chemical analysis of a coke we are concerned with the sulphur and ash content for obvious reasons. The other factor in this category is the volatile matter content. This represents the gases remaining in the coke after carbonization and is an index of the extent of coking. However, our interest is its effect upon the combustion properties of the coke.

If the volatile matter in the coke is of the order of 1 per cent, the coke is satisfactory. As this percentage increases we can expect the coke to burn faster and also to become softer. This is undesirable because with the same amount of air introduced the coke will be consumed in less time, the bed will be lost and poor iron result.

Actually in most cases the physical properties of the coke are the most important ones to be considered. In this category we have size, strength, weight per cubic foot, and porosity. At the risk of oversimplification we can state that if we consider size and strength alone we will have an index of quality more important in general than all the other factors combined.

This is understandable if we consider the function of the coke in the process. One of the fundamental principles governing all cupola operations is that the entire column, including the bed, must have sufficient voids to permit the free flow of the

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gases originating in the bed by the combustion of the coke. It is quite evident, therefore, that the coke must be regularly sized, and the metal stock also must conform in this respect.

If the coke in the bed is small either because of its original size or by subsequent handling is badly broken, then the void space is reduced and the gases following the line of least resistance are directed in greater quantity to travel upward along the wall of the cupola instead of through the charge.

Accompanying illustrations show the condition of a bed of coke when it is regularly sized and also when it is broken either by improper handling or because of its weak structure.

Influence Burning Rate

The rate at which a coke will burn is a direct function of its native combustibility and its size. Other factors affect this feature also but are not as effective. The smaller the coke the greater is its surface area and the more rapidly it will burn. This is the reason why a uniformly small coke will burn in an area closer to the tuyeres, resulting in a low maximum temperature zone. Under this condition a very slow melting rate will exist. If the air is increased to speed up the melting rate, burning of the bed is disturbed and a high state of oxidation will exist.

Conversely a large coke will have larger voids, the gases will distribute better, a more uniform hot zone exists, but the bed must be higher, because the reduced coke surface will not consume the oxygen as fast. When properly adjusted, high melting rates and metal temperatures exist.

It must be remembered, however, that if the coke is fast burning the above conditions change rapidly, and adjustments in the quantity of coke used will have to be made to compensate for this condition.

In small and medium-size cupolas it is inadvisable to use large size coke because free oxygen would exist at too high a point, requiring an extremely high bed to protect the iron.

In discussing coke sizes we must distinguish between a coke with a wide spread in sizes and a coke of the same average size but with more uniform pieces. The latter is the preferred condition if a choice exists.

If the question of coke size is so important then, the cupola operator has a direct responsibility in properly handling this material in his own plant. Most producers of coke go to considerable expense and trouble to properly size and load the coke into cars, and it is a sad reflection on most foundries that this material is handled in much the same manner as scrap.

Coke by its very nature is friable, and so long as it is produced in its present manner it will remain so. It should never be unloaded by means of a clamshell (Fig 6) no matter how much money is saved in labor by doing so. Under all conditions it should be rescreened before using. In actual field work we have been able to remove the fines and reduce the quantity of coke used in the cupola by an amount greater than the fines removed. The resulting improvement in operation in all respects is phenomenal, and the saving more than justifies the loss represented in the coke fines.

In connection with the proper interpretation in the use of coke it must be pointed that all too frequently coke is charged with the responsibility of correcting all or most of the accumulated abuses of bad practice. For example, conditions have been encountered where a blower with a capacity in excess of that required for the particular cupola would be running at full rate. This surplus air was neutralized only by adding coke in excess of what would be considered a normal amount. This is not only an expensive correction but additionally because of the extremely poor conditions existing when the coke shifted in quality, immediately the balance was upset and of course the iron suffered. The reverse of this has also been encountered, where with a blower of insufficient capacity the coke ratio is reduced to obtain the tonnage demanded, making the iron highly sensitive to any changes in operation.

(To be concluded next month)

Honor Employees

Oliver Machinery Co., Grand Rapids, Mich., held a dinner Oct. 26 in honor of employees who have been with the company 20 years or more. Forty-three veterans have received the 20-year service award, a gold lapel button in the form of the company's eagle trademark. Thirty-year veterans, numbering 27, receive gold wrist watches, and employees who have been with the company 40 years or more are awarded extra vacation time each year. This latter group includes: John Lenderink, who has been with the company since Aug. 18, 1901; Arthur Blake, 1906; A. S. Kurkjian, 1908; G. C. Conklin, 1909, and G. W. Crosley, 1909.

CASTING THE LARGE

Statue of Washington

(*Continued from page* 75)

cope, face up, is placed on the floor and partly filled with sand. The plaster pattern is adjusted approximately in the center with the natural parting line conforming as nearly as possible with the joint line of the flask. In this instance the cope merely serves as a follow board to hold the pattern in place while the drag is rammed full of sand. Exposed part of the pattern is covered with French sand, for many years considered absolutely essential for the purpose. A few years ago a prominent eastern sand supply firm developed a special sand mixture for which claim is made that it is quite as satisfactory as the French variety.

Form Bottom Plate

Two or three steel channels, depending on the size of the flask, are bolted on the drag to serve as a bottom plate. The channels are reinforced with a short length of steel rail bolted across the center. With the cope and drag bolted together the assemblage is rolled over and the false cope is removed. The sand is shaken out and the empty cope is placed near by until the many small cores or drawbacks have been rammed individually over the exposed face of the pattern. The same procedure was observed while ramming the drag part.

Arbors for reinforcing cores and drawbacks are made from pieces of ½ to ¾-in. square section bars. They are bent to the required shape and the various parts are wired firmly together at points of intersection. Short pieces of steel pipe are incorporated in the arbors in instances where the core is to be lifted or turned over while green. The entire upper surface of the pattern is covered with the small cores or sand blocks. After they are arranged in proper position, the cope is set on and rammed full of sand. Suitable gate sticks are arranged in the cope to provide a channel between the runner basin and the numerous small gates.

The distance that molten metal will flow depends on the fluidity and volume. A large, thick stream will remain in the liquid state and flow farther than a small thin stream exposed to the temperature-robbing effect of the mold walls. The walls of a statue or other piece of ornamental bronze are relatively thin, and the metal from a gate, irrespective of its fluidity, will not flow far from the source. To meet these conditions the

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metal is introduced through a multiplicity of gates, each one designed to fill a definite area of the mold. Also, and this is one of the most important points, the metal in each area must be in a fluid condition when it meets metal from adjoining areas, so that the metal in the various areas will unite to form an unbroken entity.

No definite rule can be laid down on this subject since these castings largely are of an individual character and in the great majority of instances are not duplicated. Almost without exception the detail of gates for any given casting is peculiar to itself. However, the general principle is the same in all cases. A large reservoir, or basin, is erected on top of the mold and a large sprue from the bottom conducts the metal to the required number of gates leading to various parts of the mold cavity. In effect, the main sprue with its numerous ramifications may be compared to a tree stump and its numerous roots. The tip of each root forms a gate opening. On large jobs the roots vary from a few inches to several feet in length, and from a fraction to over an inch in diameter. They are not straight, but are bent to one or several angles. The gates are wax, which melts while the mold is in the oven. The finished casting released from the sand is enclosed in a network of metallic grapevines.

Method adopted for making the main core in one of these castings differs materially from that employed in ordinary foundry practice where a sweep or a corebox is supplied for the purpose. In this instance the mold is utilized for a corebox and is rammed full of sand. The mold then is taken apart. A thickness of sand corresponding to the desired metal thickness of the casting is shaved from the core. Briefly the foregoing describes the process, but from the intricate character of the work it is apparent that progress is slow, and that the highest degree of skill and accuracy is required on the part of the operator.

A frame or arbor, as referred to previously and conforming approximately to the general contour of the mold, is fitted in the drag part of the mold. Projecting members of the arbor rest on the joint of the mold and anchor the core in place. The mold is rolled over and the drag part is lifted off to expose one half the core. Short nails with broad heads are inserted within a few inches of each other all over the surface. The heads are flush with the sand surface and furnish a reliable guide for the removal of the required thickness of sand. In this method the core is not removed from the mold. It is left in place. The thickness of sand is removed first from the drag side, and then from the cope side after the mold is rolled over the second time.

In a second method, as shown in Fig. 10, the core is lifted out of the mold, shaved and then returned to place. This obviates rolling the mold

Designer of Washington Statue Is Noted Sculptor

BRYANT BAKER, designer of the colossal George Washington statue, was born in London, descendant of a long line of sculptors. With his father and his grandfather he worked on the decorative carving in Westminster Abbey. A brother also is a well known sculptor. Mr. Baker has lived in the United States for nearly 50 years. During World War I, he served with the Medical Corps of the AEF.

The Nov. 1, 1928 issue of The Foundry contained an article on another of Mr. Baker's well known bronze group, the "Pioneer Woman," erected in Ponca City, Okla. The design was selected by popular vote from a group submitted by 12 leading American sculptors. Other notable contributions by Mr. Baker include models for four former presidents—Coolidge, Wilson, Roosevelt and Taft. The Supreme Court has four marble statues of the last four Chief Justices of the United States. Six of his creations are in the National Capitol building, Washington. Herbert Hoover, General Pershing and three Chief Justices have been among his sitters. In England, his statue of King Edward VII at Huddersfield was unveiled by George V at the special request of dowager Queen Alexandra.

Mr. Baker maintains a studio at 222 West 59th street, New York.

twice to obtain the proper position.

Having served their purpose the nails are removed and the surface of the core is painted with a thin solution of blacking in molasses water. Under certain conditions, to prevent sagging during the drying period, also to prevent sand from falling into the mold cavity, wax sheets are placed between core and mold face. The wax melts and runs out or is evaporated while the mold is in the oven. The dried mold is taken from the oven and assembled. The small cores and drawbacks are attached to the face of the mold with small hooks and wires.

All gates are directed toward one or two upright sprues, near one end or one side of the cope. A large basin capable of holding the required amount of metal, is prepared, dried and placed on the cope with the opening or openings in the bottom coinciding with the sprue or sprues in the cope. A clay plug built around an iron rod is placed in each opening. The rod extends above the top of the basin and terminates in a loop or ring by which it is lifted after the basin is filled with molten metal. Where the basin is not large enough it is filled with metal and then kept filled from a ladle. A small riser on the highest point of the mold indicates when the mold is full. Surplus metal is drained from the basin through a tap hole at one side. Usually the extra metal is returned to the melting furnace, to form part of a succeeding charge.

Various mixtures are used for statuary castings. One of the most widely used is the familiar eighty-five, three fives—copper 85 per cent, and 5 per cent each of tin, lead and zinc.

Offers Course In Air Pollution

University of Michigan, School of Public Health, Ann Arbor, Mich., is offering an interservice training course on air pollution Feb. 6-8. The course covers identification of the problem, tools used in investigation and determination of solution of problems, and approach employed in solution of some of the problems involving common industrial and other sources of air pollution.

Enrollment applications should be submitted to the School of Public Health; the fee is $5. A limited number of rooms are available at the University of Michigan Union. Rooming applications should state that the request is in connection with attendance of this course.

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MELT QUALITY

(*Continued from page 96*)

of melt quality.

(5) To urge foundrymen to consider the manufacture of bronze castings for pressure service in an advanced category relative to other castings which they produce.

To do this, it will be necessary:

(a) To follow well known principles in the storage, melting and pouring of metals.

(b) To test melt quality frequently and systematically; the method outlined in this paper is a satisfactory method for doing this.

(c) To apply the laws of controlled directional solidification to correctly designed castings.

Development of the Test Piece—A test casting to evaluate the effect of gas separation during solidification should meet the following requirements:

(1) The test section must be adequately fed to isolate the relative effects of gas separation and shrinkage.

(2) Gas pickup by the metal during pouring or in flowing through the mold must be a minimum.

(3) The test piece must feed properly over an extended range of pouring temperatures.

(4) The test casting must be large enough to provide test metal free from the initial chilling effect of the mold.

(5) Preferably the test piece should be applicable as a quick furnace test, and should be cheap and dependable.

The simplest casting which could fulfill these requirements would be a small tapered ingot with an open riser.

Twelve castings of the design and dimensions given in Fig. 5 were selected for preliminary test. (Details of equipment and procedure are given in Appendix 1.) Twelve additional test castings were poured in the same manner, except that the risers were insulated with a sleeve ½-in. thick surrounding the riser cavity.

These 24 specimens were then sectioned for examination, as indicated in Fig. 6. Specimens were taken for fracture, etch test, density determinations and transverse radiographic inspection. Radiographs of the specimens from series Q and R, and specimens 1S1, 1S2, 2S1 and 2S2 indicated metal of apparent radiographic soundness. (Less than approximately 2 per cent void).

A distinctly porous area is evident in specimen 1S3, when the riser was formed in molding sand. Specimen 2S3, cast with an insulated riser, was radiographically sound. Fig. 3 is a contact print of the radiograph of the ⅛-in.-thick transverse sections taken from these two test specimens. The radiographic technique is described by Lutts as follows: 140 kva., 5 ma, 36 in. distance, focus to film, Type M film, three-minute exposure for the ⅛-in. section, and two .005-in. lead intensifying screens in the cassette.

The three specimens made with uninsulated risers (1T series) showed considerable porosity; series 2T, with insulated risers, were markedly denser. Table I shows results obtained from .505-in. tensile test bars machined from a vertical section taken from the test casting of the T series.

Etch patterns of these specimens, using 50 per cent nitric acid etchant, Fig. 4, indicate that sound metal is characterized by well-defined grains, usually distinctly columnar in orientation. Porosity in cast specimens of the composition used in these tests has always been associated with poorly-defined, roughly equiaxed crystals.

Visual examination of specimens fractured by impact at room temperature reveals that sound metal gives a fracture which is uniform in texture and color. Porous metal reveals a discolored fracture which is uneven in texture.

From these tests it was concluded that specimen S3, with insulated riser, fulfills the requirements for a test casting. This design was selected for further tests to determine its overall satisfactoriness as a criterion of melt quality of bronze.

Results of Shop Tests—Twenty-one separately cast specimens of design S3 (with insulated riser) were poured at random from 16 heats in a co-operating foundry over a period of two weeks. Several hundred such tests have been made, but the results of this first series are completely representative of the overall picture. Details of the equipment and procedure are given in Appendix 2.

Sections ⅛-in. thick for transverse x-ray and rectangular specimens for

THE FOUNDRY Index Ready

The index to Volume 77 of THE FOUNDRY, listing by title, subject matter and author the editorial material published during 1949, is available for distribution. Subscribers may obtain copies on request.

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specific gravity measurements were removed, as shown in Fig. 6. Experimental data from these specimens are given in series *A* of Table II.

Six additional heats were prepared from commercially pure virgin ingot. In this case, the copper, tin, lead and nickel were melted and superheated to approximately 2225°F. The zinc required was then added before removal of the melt from the furnace. An addition of 4 oz of 15 per cent phosphor-copper shot, per 100 lb of melt, was made to the pouring ladle. Actual pouring temperatures for the 12 tests of series B are not given because temperature measuring equipment was not available at the pouring floor. Temperatures were measured at the skimming station, and from previous measurements in similar tests at the shop, a good approximation is:

First mold poured: 2100±20°F
Last mold poured: 2030±20°F.

Data from the test specimens from these six heats are listed in series B, Table II.

The appearance of the fractured surface gives an excellent indication of the quality of the melt. Comparison of the fractures with radiographs, density measurements, and etched macrostructures shows that any extensive region of discoloration (this discoloration may vary from light orange through red to mottled and black) visible on a fractured surface denotes some order of unsoundness. The outer bands of sound metal (the so-called "pressure-tight skin") can be used as a guide to estimate the seriousness of the porosity. An operator can quickly acquire the necessary skill to determine good, bad and passable heats by using the fracture test of the test specimen described.

The data in series A, Table II, show that voids of from less than 1 to as much as 9 per cent may be expected in an adequately fed section using typical shop melting equipment, materials, and procedures. Using commercial purity virgin ingot and adding zinc just prior to pouring produced void volumes of from 0.6 to 2.5 per cent in similar tests using the same melting equipment. These melting conditions were probably not adequate for absolute control of gas-forming elements. This is not in any way a comparison of ingot versus virgin metal; the ingot used at the time of these tests may not have been properly handled and/or stored. Also, the use of foundry scrap for melting metal for pressure work may be unwise.

A contact print of the radiograph of the ⅛-in.-thick transverse sections

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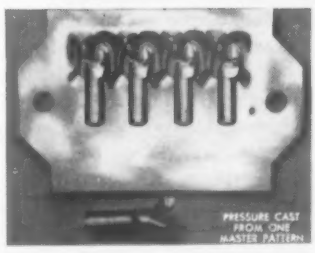

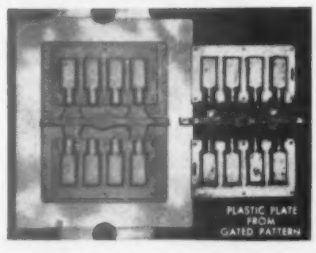

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from specimens MB and M21 is shown in Fig. 2. This illustrates the pressure-tight skin associated with well fed tin-bronze castings; it also shows the appearance of gas porosity in x-ray examination. As is illustrated by specimen M21, in the absence of gas separation during solidification, no porous areas are detectable by precise radiographic technique. The cast piece is uniformly dense, with normal tin segregation evident at grain boundaries.

Conclusions—The following specific conclusions are drawn from this work:

1. The V-block test specimen will provide metal free of voids detectable by precise radiographic technique when melts of high quality are used.

2. The test specimen will be porous when melts of inferior quality are used.

3. Visual examination of the specimen fractured by impact at room temperature is a satisfactory shop test for melt quality; the time for casting, fracture, and inspection is less than five minutes.

4. Melting performance and technique can be accurately checked by radiographic examination of thin transverse sections taken from the test piece.

5. Gas porosity is indicated on a polished and etched surface by a fine, poorly defined grain structure, even though the voids cannot be detected by the unaided eye.

6. Porosity varying from 1 to 9 per cent may be expected even in properly designed castings made under melting conditions prevailing in the average small bronze foundry.

7. Bronze castings cannot be made sound, regardless of adequacy of feeding, if gassy metal is used.

8. By using the V-block properly, it is possible for a foundryman to determine whether unsound castings are due to (1) shrinkage, (2) gassy melt, or (3) improper molds; if the test block is sound and castings poured from the same ladle under the same conditions are unsound, the trouble is shrinkage. If the V-block is unsound when poured with all proper precautions such as no contamination during pouring, use of an insulated riser and insulation of the top of the riser, the trouble is gassy melt. If the V-block is unsound when poured as above except that the metal is flowed a considerable distance through a mold made under the same conditions as the castings, and sound when poured directly into the riser, gas was picked up from the mold.

The authors are not prepared at present to offer quantitative data on the amounts or types of gases which may cause porosity in bronze castings. This will be the subject of future papers. Much work has already been published on this subject, however.

Acknowledgments — The authors express appreciation to the International Nickel Co., and in particular to Donald J. Reese of that organization, for sponsoring and encouraging the work; also, to Charles Phipps, graduate student at M.I.T., for conducting many of the experiments.

Appendix 1.—Experimental Details for Test Piece Development

The test molds for series 1Q, 1R, 1S, 1T, etc., were made in natural molding sand, typical properties being: Moisture, 6.0-6.5 per cent by weight; green compressive strength, 4.0-5.0 psi; AFS permeability, 20-30.

The insulating material used for the risers for series 2Q, 2R, 2S, etc., was metal casting plaster formed by casting a slurry, consisting of 16 parts by weight of water and 10 parts plaster of paris, into suitable molds. The preformed sleeves were dried by baking 8 hours at 450°F.

A gas-fired, crucible-type furnace with a clay-graphite crucible was used for melting. Temperatures were measured with a chromel-alumel thermocouple using a chrome-iron protection tube at the hot junction. Temperatures were taken from a millivoltmeter calibrated in degrees Fahrenheit. Ingot copper of commercial purity, commercial ingot tin, and Horsehead zinc were used to make up the charge.

The procedure was to melt the copper under a prefused flux consisting of 5 parts by weight silica sand, 3 parts borax and 2 parts cupric oxide; 1 ounce of flux was used for each pound of melt. The required tin was added after the copper was molten. This melt was then heated to approximately 2200°F, the flux was thickened with dry, sharp sand and removed, and the required zinc plunged into the melt. Three ounces of 15 per cent phosphor-copper shot per 100 pounds of melt were used for de-oxidation. Nominal composition of the bronze was 88 per cent copper, 10 per cent tin and 2 per cent zinc. Pouring temperature was 2075°F±25°F.

Appendix 2—Experimental Details for Shop Tests

Metal composition was: Copper, 86-90 per cent by weight; tin, 5.5-6.5 per cent; lead, 1.0-2.0 per cent; zinc, 3.0-5.0 per cent; and 1 per cent maximum nickel. The standard melting procedure at this shop is to use composition ingot and foundry returns, with additions of Horsehead zinc to compensate for melting loss. Melting is done in an indirect arc,

rocking-type furnace. Molten metal is transferred from the furnace to a pouring ladle, where 3 ounces of 15 per cent phosphor-copper snot are added per 100 pounds of melt for deoxidation.

Pouring temperatures were measured by means of an immersion-type chromel-alumel thermocouple with chrome-iron protection tube for the hot junction. The temperature indicator was an electronic millivoltmeter calibrated in degrees Fahrenheit.

Editor's Note: This paper was condensed from a thesis written by Mr. O'Keeffe in partial fulfillment of the requirements for the Master of Science degree at Massachusetts Institute of Technology. The paper was presented before the New England Regional Foundry Conference held at M.I.T., Oct. 7-8.

Apprentice Training Programs Reviewed

Development of apprentice training programs throughout the United States since the passage by Congress in 1937 of the National Apprenticeship Act, as well as the Eastern Seaboard Apprenticeship Conference held in June, 1949, are reviewed in an article reprinted from the *Monthly Labor Review*, U. S. Department of Labor.

Included in the article are statistics on the present number of apprenticeship programs established, apprentices in training and participating establishments, as well as the number of skilled workers employed and the additional apprentices who must be trained to meet the skilled worker demand.

Of 233,300 registered apprentices in all occupation groups as of Dec. 31, 1948, 1900 or 0.8 per cent were patternmakers, 1800 or 0.8 per cent were molders and 300 or 0.1 per cent were foundry workers not classified elsewhere. Copies of the article may be obtained from the Bureau of Apprenticeship, U. S. Department of Labor, Washington 25.

Uses of Photography Described in Film

A new motion picture describing the role of modern photography in industry has been released by the Eastman Kodak Co. and is available for private showings by arrangement with the company's Industrial Photographic Division, 343 State St., Rochester 4, N. Y. Entitled "Functional Photography in Industry," the film explains the many ways in which photography is serving industry in research, production, quality control, advertising and sales.

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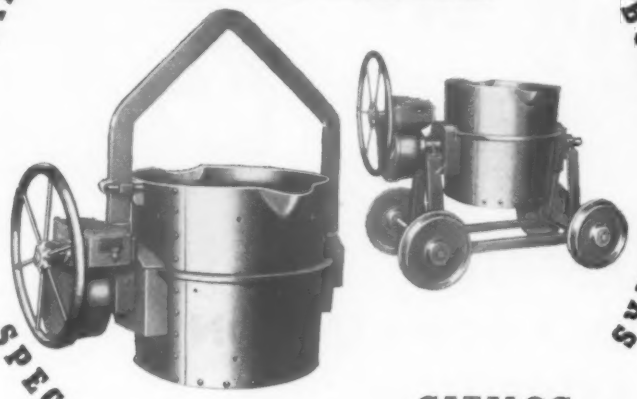

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Again the Northeastern Ohio Chapter of The American Foundrymen's Society, thoroughly experienced and seasoned in handling the many details of a convention of this size, will swing into line with the many committees and activities necessary to assure a smooth-running program.

This is just a preliminary announcement of this important event so that readers of The FOUNDRY throughout the world may make their plans to attend the convention and reserve accommodations well in advance.

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The Post Convention Issue for June

Will contain in addition to all the regular features, a story of the show, what happened, who presided at the sessions and a general and interesting story on the convention itself, interpreting it in terms of benefits to all foundrymen whether they attend the show or not. This will be a great issue after a great show!

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GRAY IRON CASTINGS: Superior Foundry Inc., 3542 East 71st St., Cleveland 5 — Illustrated booklet describes electric furnace process of producing gray iron for castings and also diagrams the steps taken in producing all types of alloyed and plain cupola gray iron castings. Containing tables, charts, diagrams and results of arbitration bar tests, the booklet offers specific factual information about the qualities of electric furnace iron.
For More Details Circle No. 90—Page 215

ALLOY: American Brake Shoe Co., Electro-Alloys Division, Taylor St. & Abbey Rd., Elyria, O. — Bulletin entitled "How to Reduce Abrasive Wear with Thermalloy HC-250" lists uses and physical properties of this abrasive-resistant material. It describes case histories of the metal, giving actual field service data in each case. Information also is included on machining and high temperature service.
For More Details Circle No. 91—Page 215

REFRACTORIES: Chas. Taylor Sons Co., 712 Burns St., Cincinnati 14 —Bulletin 312 traces the development and discusses the properties and applications of the company's special refractories. These are aluminum silicate refractories in which the alumina and silica are combined as mullite. They are supplied as standard bricks, special shapes, cements, castables, ramming mixes and patching compounds.
For More Details Circle No. 92—Page 215

MAINTENANCE CONTROL: Remington Rand Inc., Systems & Methods Research Dept., 315 Fourth Ave., New York 10 — Folder KD-449 describes and illustrates a record control system for a program of preventive maintenance of machines and equipment. A section also is devoted to inventory systems used to control stocks of replacement parts and operating supplies.
For More Details Circle No. 93—Page 215

GAS TRUCK OPERATION: Yale & Towne Mfg. Co., Roosevelt & Haldeman Ave., Philadelphia 15 — Bulletin P1170 gives instructions on how to operate gas trucks safely and with a minimum of wear to moving parts. A total of 25 hints are given; each is illustrated with a small drawing.
For More Details Circle No. 94—Page 215

DUST COLLECTORS: Aget-Detroit Co., Main and Washington Sts., Ann Arbor, Mich.—Catalog and price list contains specifications and information on new and improved model dust collectors. Applications on grinding, buffing, polishing, sanding and other dust creating operations are illustrated. A section is devoted to vapor collectors used to collect mist and vapor from thread grinding, screw machining and centerless grinding, etc.
For More Details Circle No. 95—Page 215

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SEALING AND BONDING COMPOUNDS: Western Sealant Inc., 9042 Culver Blvd., Culver City, Calif.—Leaflet describes two compounds—one a thermosetting material for use in manually repairing surface flaws, sand pitting, foundry gas holes, etc., and the other for manually bonding similar and dissimilar materials.
For More Details Circle No. 96—Page 215

REFRACTORIES: Quigley Co., 527 Fifth Ave., New York 17—Bulletin KY2730 describes a dry air-setting refractory ramming mixture; bulletin HC-103T deals with a chrome magnesite castable refractory, and bulletin CX201c describes a chrome-base plastic ramming material.
For More Details Circle No. 97—Page 215

STORAGE EQUIPMENT: Hilco Mfg. Co., 1721 North Elston Ave., Chicago 22—Catalog covers the company's line of all-steel commercial and industrial storage equipment, including adjustable steel shelving, unit bins, sorters and mailers, work organizers, and other units, both open and closed types.
For More Details Circle No. 98—Page 215

CONVEYORS: Lippmann Engineering Works, 4603 West Mitchell St., Milwaukee 14 — Bulletin 1400 presents information on stationary, portable, and 16 types of special purpose belt conveyors, both troughed and flat belt. Included are future applications and methods of selecting belt conveyors; dimensions, weights and specifications for standard head, tail and intermediate sections; lattice, channel and timber frames, and terminal machinery.
For More Details Circle No. 99—Page 215

JOBBING WORK: Hardinge Mfg. Co., 240 Arch St., York, Pa.—Bulletin AS-400 describes the company's plant facilities. Information is included regarding types of patterns, castings, machine work and plate steel work which are handled in the plant, as well as numerous examples of custom built machinery.
For More Details Circle No. 100—Page 215

HEATING UNITS: Edwin L. Wiegand Co., 7596 Thomas Blvd., Pittsburgh 8—Industrial catalog 50 describes standard electric heating units. Four basic units—strips, rings, tubulars, and cartridges—with wide variations in wattage, voltage and sheath material, are listed, as well as selection and application data.
For More Details Circle No. 101—Page 215

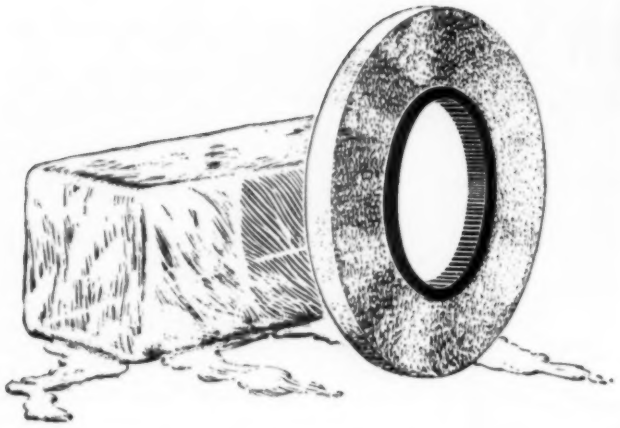
HOPPER CAR THAWER: Hauck Mfg. Co., 106 Tenth St., Brooklyn 15, N. Y.—Bulletin 1063, dealing with portable hopper car thawing tube equipment, describes a new model fitted with heavy duty torch flame heating burners and designed to operate with no compressed air or other auxiliary equipment.
For More Details Circle No. 102—Page 215

CRANES: Thew Shovel Co., 28th & Fulton Sts., Lorain, O.—Folder shows application of mobile power cranes to many kinds of material handling jobs in industry. Specific applications are shown, and magnets, clamshell buckets, hook blocks, and special slings and grabs are illustrated.
For More Details Circle No. 103—Page 215

AIR CONDITIONERS: General Electric Co., Air Conditioning Dept., Bloomfield, N. J.—Series of bulletins deal with packaged air conditioners for a wide variety of applications. Each of the bulletins describes and pictures the units and gives specifications, ratings and dimensions.
For More Details Circle No. 104—Page 215

SHAKEOUTS: Allis-Chalmers Mfg. Co., 1032A South 70 St., Milwaukee 1 —Bulletin 07B6365A presents construction features of the company's two-bearing shakeouts available in eight sizes ranging from 4 x 6 ft with capacity of 4 tons to 8 x 10 ft with capacity of 25 tons.
For More Details Circle No. 105—Page 215

DUST MASK: Mine Safety Appliances Co., Braddock, Thomas, & Meade Sts., Pittsburgh 8—Bulletin CM-10 describes an all-vision dust mask which is said to provide complete facial and respiratory protection against nuisance and harmful dusts.
For More Details Circle No. 106—Page 215



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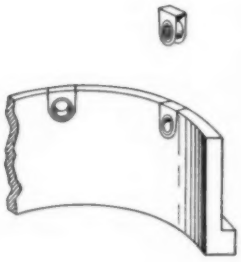

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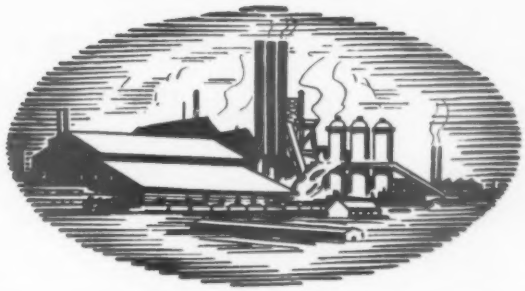

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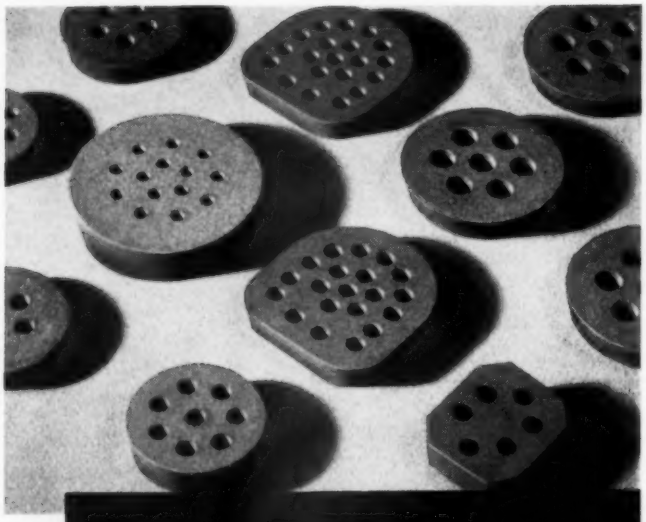

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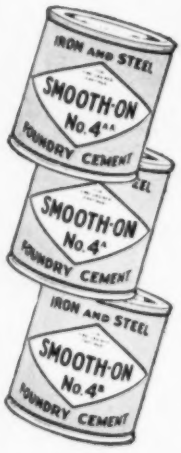

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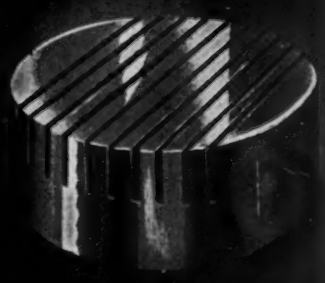

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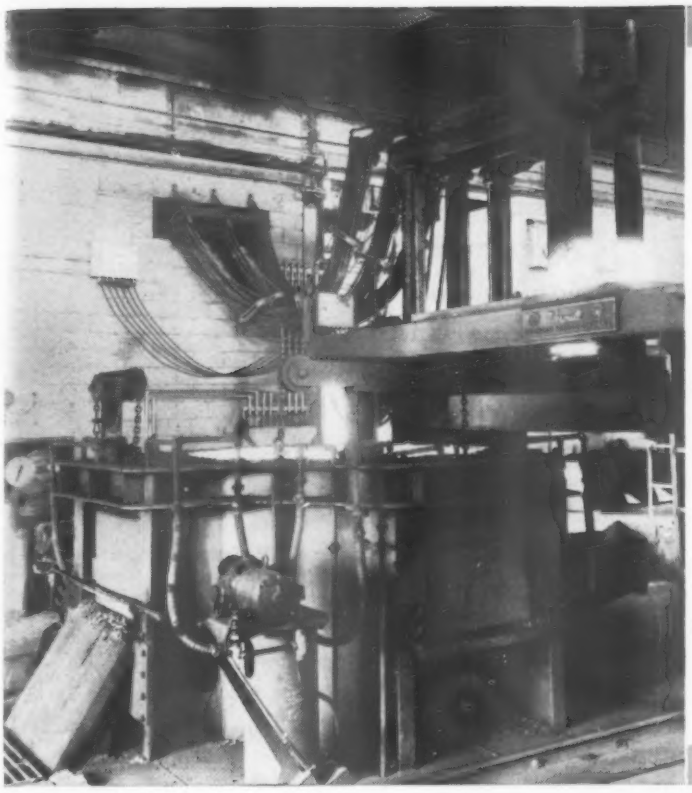

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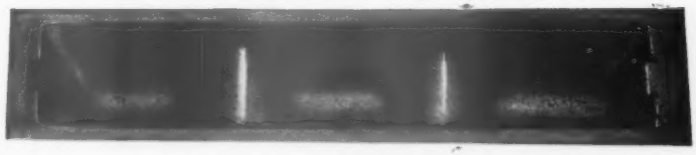

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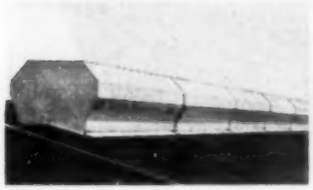

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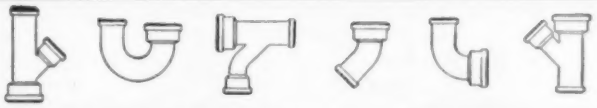

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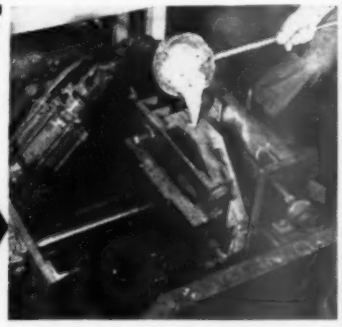

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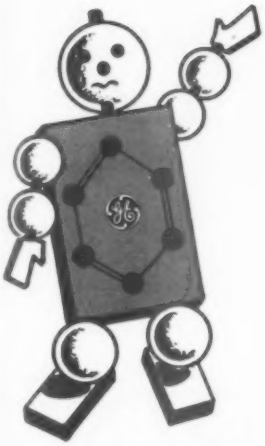
WITH G. E.'S *NEW* LIQUID RESIN CORE BINDER



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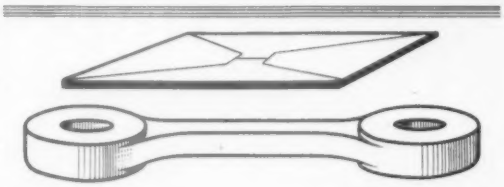

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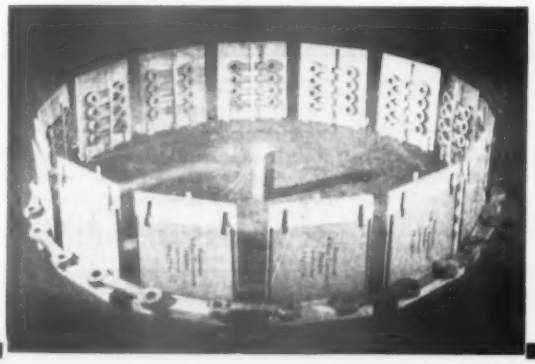

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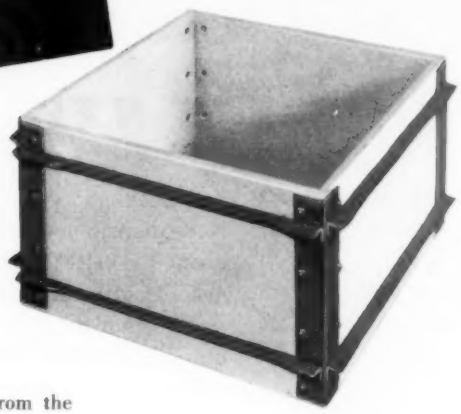

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On jackets up to 8" deep, *Single* reinforcement angle irons are used. Deeper jackets have *Double* reinforcement angle irons.

These top-quality slip jackets **strip clean** from the mold every time! Made of Monasbestos one-half inch thick, CMD Slip Jackets will not burn . . . and they shed molten metal quickly and completely. Strong corner irons and cross reinforcing irons prevent warping. The corner irons are bolted to the jacket and the reinforcing members are arc-welded in place to assure permanent rigidity. **Write today for descriptive circular 250-F.**

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CASTINGS PEEL BETTER
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Used for Silica wash, oil, water or any liquid material. For sand-blast cleaning. As a blow gun for cleaning motors and machinery. If your dealer cannot supply you at once, order direct from manufacturer below. Literature on request.

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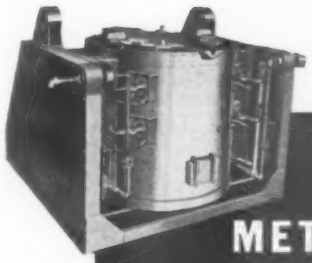

'Surface'

NON-FERROUS

METAL MELTING FURNACES

SELECTION TABLE

	TYPE	Max. Temp.	Series	Recommended for	Bulletin No.
TILTING	CRUCIBLE	2500°F.	TCR	Melting Brass and Copper	TC-45
		1400°F.	TCA	Melting Aluminum	TC-45
	POT	1400°F.	TP	Melting Aluminum and Magnesium	TP-45
STATIONARY	CRUCIBLE	2500°F.	CR	Melting Brass and Copper	CR-45
		1400°F.	AC	Melting Aluminum	AC-45
	POT	1400°F.	AM	Melting Aluminum	AM-45
		1200°F.	SM	Melting Soft Metals	AM-45
		1000°F.	SA SAV	Melting Soft Metals	SV-49

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Use the Simplified PYRO Optical Pyrometer

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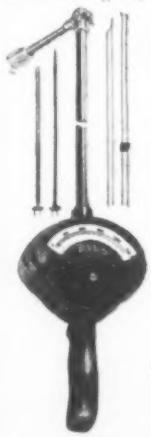

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Helps insure low-cost production of SOUND, UNIFORM Castings. Has shielded steel housing which is shock-proof, dust-proof and moisture-proof—withstands roughest handling. "Protected Type" and "Bare Metal" thermocouples are instantly interchangeable, without adjustment or recalibration. Large 4-inch easy-reading dial. Equipped with exclusive LOCK SWIVEL. Ranges: 1-1500° and 0-2500° F. *Write for FREE Catalog #150*

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The cooler cutting properties of Manhattan Cut-Off Wheels makes it easier for a foundryman to remove gates and risers without burning or checking the metal of a costly casting. The Manhattan wheel pictured above is cutting a foundry cast suction head for a chemical pump. The metal is 19% chrome and 24% nickel with some copper content. Tests show that Manhattan Cut-Off Wheels make quicker work of each cut and more cuts per wheel.

They last longer and leave a better surface which also saves on final finishing time. When modern cut-off machines and tough alloys consume many wheels per day, it is worthwhile to test for yourself the savings that are possible with Manhattan Cut-Off Wheels.

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MANHATTAN RUBBER DIVISION

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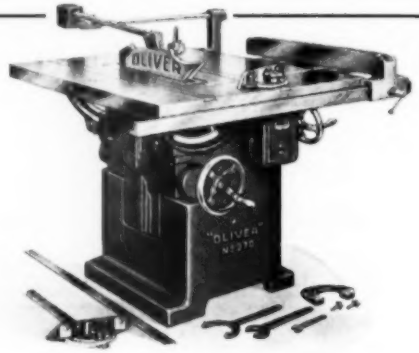
"OLIVER"

MEDIUM SIZE TILTING ARBOR NO. 270-D

Saw Bench



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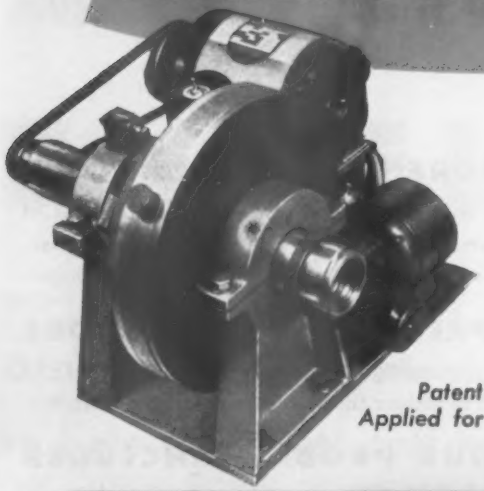

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- This amazing new proving machine will give you accurate test of *any* blasting shot or grit.
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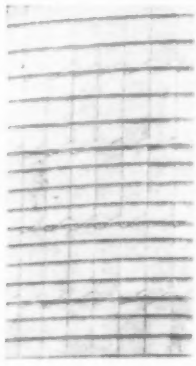

The photograph at the right shows a small area of a Neff & Fry storage bin wall. Notice the pattern of the Super-Concrete Staves with their diagonally pointed ends. You can see that each stave interlocks with six adjoining ones; also that the steel hoops around the horizontal joints impinge directly upon the points of the staves.

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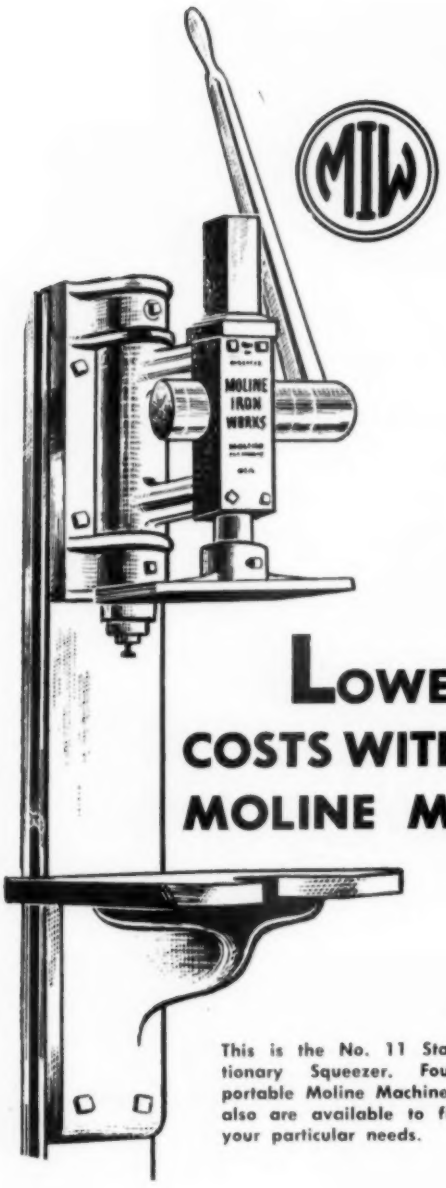

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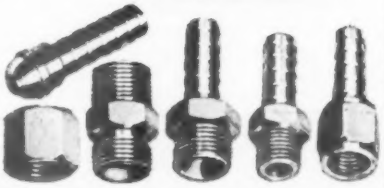

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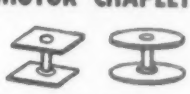

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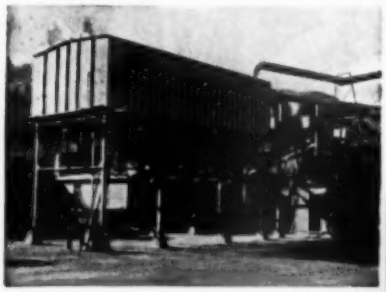

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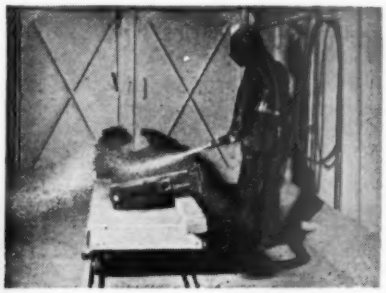

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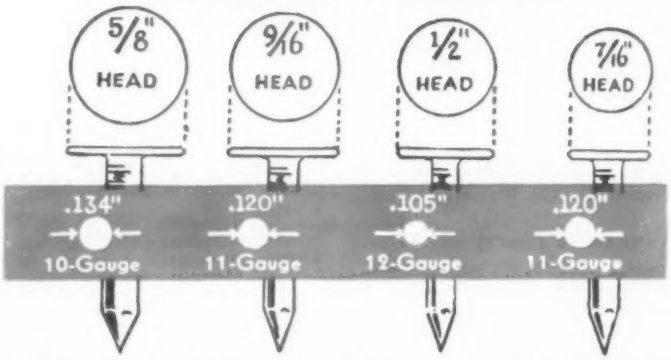

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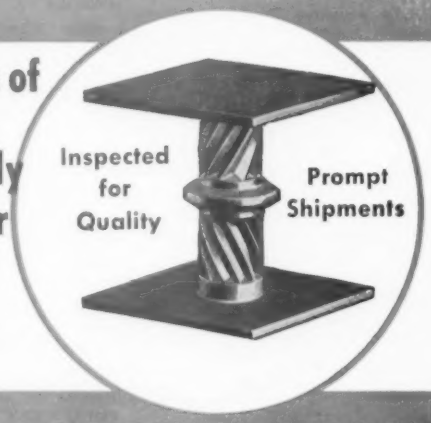

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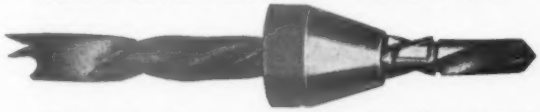

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Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Corn Products Sales Co., 17 Battery Pl., New York 4, N. Y.
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Hercules Powder Co., Wilmington 99, Del.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Chas. A. Krause Milling Co., 404 E. State St., Milwaukee 1, Wis.
Robeson Process Co., 500 Fifth Ave., New York 18, N. Y.
Superior Flake Graphite Co., 33 So. Clark St., Chicago 3, Ill.
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Velsicol Corp., 330 E. Grand Ave., Chicago 11, Ill.

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Robinson Clay Product Co., 65 West State St., Akron 8, Ohio.
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati 14, O.

FIRE SAND

Carborundum Co., Niagara Falls, N. Y.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FIRESTONE

Cleveland Quarries Co., 1740 E. 12 St., Cleveland 14, O.

FLASK BANDS

Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

FLASK BUSHINGS

Black, Sivalls & Bryson, Inc., 720 Delaware, Kansas City 6, Mo.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
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Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Universal Engineering Co., Frankenmuth, Mich.

FLASKS (Aluminum)

Adams Co., Dubuque, Iowa.
Foundry Service Co., Birmingham, Ala.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASKS (Dowmetal)

Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASK FILLERS

Bartlett & Snow, C. C., Co., 6201 Harvard Ave., Cleveland 5, O.

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Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., Columbus 16, O.

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Adams Co., Dubuque, Iowa.
Fremont Flask Co., Fremont, O.
Freeman Supply Co., Toledo 5, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

FLASKS (Snap)

Adams Co., Dubuque, Iowa.
Fremont Flask Co., Fremont, O.
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Stevens, Inc., Frederic B., Detroit 16, Mich.

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Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

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Black, Sivalls & Bryson, Inc., 720 Delaware, Kansas City 6, Mo.
Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

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Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

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Dougherty Lumber Co., 4300 E. 66th St., Cleveland 5, O.
Rietz Lumber Co., 1800 N. Central Park Ave., Chicago, Ill.

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Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.

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FLUXES

American-British Chemical Supplies Inc., 180 Madison Ave., New York 16, N. Y.
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Mathieson Chemical Corp., Mathieson Bldg., Baltimore 3, Md.
National Pigment Co., East York St., Philadelphia Pa.

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Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
Puro-Seal Co., 2323 West Third, Cleveland 13, Ohio.

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Standard Horse Nail Corp., New Brighton, Pa.

FOUNDRY SHOVELS
(See SHOVELS)

FOUNDRY SUPPLY HOUSES

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Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
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Ajax Electric Co., Inc., Philadelphia 23, Pa.

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Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1851 Columbus Rd., Cleveland 13, Ohio.
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Ajax Metal Co., Philadelphia 23, Pa.
Campbell-Hausfeld Co., 300-320 Moore St., Harrison, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

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Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
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Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
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Campbell-Hausfeld Co., Harrison, O.
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Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Company, 750 Prospect Ave., Cleveland 15, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
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Despatch Oven Co., Minneapolis 14, Minn.
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Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

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Ajax Electrothermic Corp., Trenton, N. J.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
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Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13 Ohio.
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Crobaugh Co., Frank L., 1426 West Third St., Cleveland 13, Ohio.

METERS (Gas, Air, Water)

Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Roots-Connersville Blower Corp., Connersville, Ind

MIXERS (Core Wash)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Multiplex Machinery Corp., Elmore, Ohio.

MIXERS (Sand and Clay)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Blystone Division, Standard Sand & Machine Co., 549 W. Washington St., Chicago 6, Ill.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Co., Waterloo, Iowa.
Fordath Engineering Co. Ltd., West Bromwich, Birmingham, England.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Multiplex Machinery Corp., Elmore, Ohio
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.
Sather Mfg. Co., Everett, Wash.

MODELS (Wood)

Master Pattern Co., 1315 Main Ave., Cleveland, Ohio.

MOLD CONVEYORS

Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.

MOLD CONVEYORS (Cont'd.)

National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.

MOLD DRYERS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

MOLD OVENS and DRYERS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, O.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Ross Engineering Corp., J. O., 350 Madison Ave., New York 17, N. Y.

MOLD TRUCKS (Power Operated)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.

MOLD WASH

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.
United States Graphite Co., Saginaw, Mich.

MOLDERS TOOLS

Monk Tool Co., Union Street, Geneva, Ill.

MOLDING MACHINES

Adams Co., Dubuque, Iowa.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Foundry Service Co., Birmingham, Ala.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.
Moline Iron Works, Moline, Ill.
Nichols, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Stone-Wallwork Ltd., 252 Victoria St., London, England.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Jolt)

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1553 West Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Stone-Wallwork Ltd., 252 Victoria St., London, England.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Rollover)

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Squeeze)

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis
Moline Iron Works, Moline, Ill.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Stone-Wallwork Ltd., 252 Victoria St., London, England.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING SANDS

Great Lakes Foundry Sand Co., United Artists Bldg., Detroit 26, Mich.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

MOLYBDENUM

Molybdenum Corporation of America, Pittsburgh 19, Pa.

MONOGRAMS & TRADEMARKS

H. P. Maughlin Co., 953 Ingleside Ave., Columbus, Ohio.

MONORAIL SYSTEMS

American Monorail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

MOTORS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.

NAILS (Chill)

Angell Nail & Chaplet Co., 4580 E. 71st St., Cleveland 5, O.
Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.
Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.
Standard Horse Nail Corp., New Brighton, Pa.

NICKEL

International Nickel Co., Inc., 67 Wall St., New York City 5.

NITROGEN

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

NOZZLES (Blasting)

Alloy Metal Abrasives Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Davenport Machine & Foundry Co., Davenport, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Co., Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, O.

OIL BURNERS

Hauck Manufacturing Co., 106 Tenth St., Brooklyn 15, N.Y.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

OVENS (Annealing and Heat Treating)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., Salem, Ohio
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Lindberg Engineering Co., Fisher Furnaces Div., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

OVENS (Core) **(See CORE OVENS)**

OVENS (Enameling, Japanning)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Detroit Sheet Metal Works, 1300 Oakman Blvd., Detroit, Mich.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

OVENS (Mold)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Detroit Sheet Metal Works, 1300 Oakman Blvd., Detroit, Mich.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

OXYGEN

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

PARTING COMPOUNDS

Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Frederic B. Stevens, Inc., Detroit 16, Mich.

PARTING COMPOUNDS (Cont'd.)

E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PATTERN COATINGS

American Lacquer Solvents Co., Phoenixville, Pa.

PATTERN COMPOUND

Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PATTERN LETTERS

Freeman Supply Co., Toledo 5, O.
H. P. Maughlin Co., 953 Ingleside Ave., Columbus, Ohio

PATTERN LUMBER

Dougherty Lumber Co., Cleveland 5, O.
Freeman Supply Co., Toledo 5, O.
Rietz Lumber Co., 1800 N. Central Park Ave., Chicago, Ill.

PATTERN MATERIAL (Plastic)

G. G. Schroeder & Co., 1416 South Penn Square, Philadelphia 2, Pa.

PATTERN METAL

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

PATTERN PLATES

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.
Buffalo Pattern Works, 830 Hertel Ave., Buffalo, N. Y.
Central Pattern Co., Quincy, Ill.
City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Foundry Service Co., Birmingham, Ala.
Freeman Supply Co., Toledo 5, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Plaster Process Castings Co., 6922 Carnegie Ave., Cleveland 3.
Scientific Cast Products Corp., 1388-92 E. 40th St., Cleveland 3, O.
Arthur E. Will, 643 West 11th St., Erie, Pa.

PATTERN PLASTER

United States Gypsum Co., 300 W. Adams St., Chicago, Ill.

PATTERN PLATE STOCK

Freeman Supply Co., 1152 Broadway, Toledo 5, O.

PATTERN SHOP EQUIPMENT

Freeman Supply Co., 1152 East Broadway, Toledo 5, Ohio.
Oliver Machinery Company, Grand Rapids 2, Mich.

PATTERN SUPPLY HOUSES

Freeman Supply Co., 1152 East Broadway, Toledo 5, Ohio.

PATTERNS

Industrial Pattern Works, 2621 Belmont Ave., Chicago 18, Ill.

PATTERNS (PLASTIC)

Central Pattern Co., Quincy, Ill.
Plastic Corp. of Chicago, 2444 So. Central Ave., Cicero 50, Ill.

PATTERNS (Wood, Metal)

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.
Buffalo Pattern Works, 830 Hertel Ave., Buffalo, N. Y.

PATTERNS (Wood, Metal) (Cont'd.)

Central Pattern Co., Quincy, Ill.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Master Pattern Co., 1315 Main Ave., Cleveland, Ohio.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Wellman Bronze & Aluminum Co., 2525 E. 93rd St., Cleveland 4, O.
Arthur E. Will, 643 West 11th St., Erie, Pa.

PERMANENT MOLD COATINGS

Acheson Colloids Corp., Port Huron, Mich.

PERMANENT MOLDS

Master Pattern Co., 1315 Main Ave., Cleveland, Ohio.

PHOSPHOR COPPER

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

PHOTOGRAPHIC EQUIPMENT

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

PHOTOGRAPHY (Industrial)

Eastman Kodak Co., Rochester, N. Y.

PIG IRON

Globe Iron Co., Jackson, Ohio.
Jackson Iron & Steel Co., Jackson, Ohio.
Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.
Pickands, Mather & Co., Cleveland 14, O.
Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.
Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.
Woodward Iron Co., Woodward, Ala.

PIG IRON (Silvery)

Globe Iron Co., Jackson, Ohio.
Jackson Iron & Steel Co., Jackson, O.
Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.

PINS (Flask)

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N.E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.
Universal Engineering Co., Frankenmuth, Mich.

PISTON RINGS (for Molding Machines, Compressors, etc.)

Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.

PLANT ENGINEERING SERVICE

Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.

PLANT ENGINEERING SERVICE (Cont'd.)

Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

PLASTER of PARIS

United States Gypsum Co., 300 W. Adams St., Chicago, Ill.

PLATES (Bottom)

Adams Co., Dubuque, Iowa.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

PLATES (Core Drying)

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Johns-Manville, 22 East 40th St., New York 16.

PLATING TEMPERATURE CONTROLS

Foxboro Company, Foxboro, Mass.

PLUMBAGO

Bloomsbury Graphite Co., Bloomsbury, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Service Co., Birmingham, Ala.
Frederic B. Stevens, Inc., Detroit 16, Mich.
United States Graphite Co., Saginaw, Mich.

PNEUMATIC TOOLS

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, Ohio.
Gardner-Denver Co., Quincy, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Rotor Tool Co., 17225 Euclid Ave., Cleveland 12, Ohio.
Schramm Inc., West Chester, Pa.

POURING DEVICES

Industrial Equipment Co., Minster, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

PRESSER BOARDS

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

PRESSES (Hydraulic)

Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

PRESSURE CASTING SEALER

Empire Varnish Co., 2636 E. 76th St., Cleveland 4, O.

PRESSURE RECORDERS

Foxboro Company, Foxboro, Mass.

PROTECTIVE MATERIALS (X-Ray)

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

PULLEYS (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

PUMPS

Construction Machinery Co., Waterloo, Iowa.
Gardner-Denver Co., Quincy, Ill.

PUMPS (Dry, Vacuum)

Allis Chalmers Mfg. Co., Milwaukee 1, Wis.
Fuller Company, Catasauqua, Pa.
Roots-Connersville Blower Corp., Connersville, Ind.

PURIFIERS

Cleveland Flux Co., 1026 Main St., Cleveland 13, O.

PUSH-OFF MACHINES

Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.

PUTTY (Foundry)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

PYROMETERS

Foxboro Company, Foxboro, Mass.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.
Pyrometer Instrument Co., Bergenfield, N. J.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PYROMETERS (Immersion)

Pyrometer Instrument Co., Bergenfield, N. J.

PYROMETERS (Optical)

Pyrometer Instrument Co., Bergenfield, N. J.

RACKS (Core Ovens)

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

RADIOGRAPHY (Industrial)

Eastman Kodak Co., Rochester, N. Y.
Radium Chemical Co., Inc., 570 Lexington Ave., New York 22, N. Y.

RADIUM

Radium Chemical Co., Inc., 570 Lexington Ave., New York 22, N. Y.

REFRACTORIES

Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Carborundum Co., Perth Amboy, N. J.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.
Eastern Clay Products, Inc., Jackson, O.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
A. P. Green Fire Brick Co., Mexico, Missouri
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Ironton Fire Brick Co., Ironton, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

REFRACTORIES (Cont'd.)

Norton Co., Worcester 6, Mass.
Robinson Clay Product Co., 65 West State St., Akron 8, Ohio.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati 14, Ohio
United States Graphite Co., Saginaw, Mich.

RESPIRATORS

Chicago Eye Shield Co., 2300 West Warren, Chicago 12, Ill.
Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.
Wilson Products Inc., Reading, Pa.

RIDDLES

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

RIDDLES (Electric)

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Great Western Mfg. Co., Leavenworth, Kans.,

RIDDLES (Hand)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

ROD DIP

Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.

ROD STRAIGHTENERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

RODS (Steel)

Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.

ROLLER-HEARTH FURNACES (Electric Annealing)

General Electric Co., Schenectady, N. Y.

RUBBER LINING MATERIAL (Abrasive Resisting)

Pangborn Corp., Hagerstown, Md.

SAFETY CLOTHING

American Optical Co., Southbridge, Mass.
Chicago Eye Shield Co., 2300 West Warren, Chicago 12, Ill.
Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.

SALT and SALT TABLETS

Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.

SAND ARRESTER TUBES

Martin Engineering Co., Kewanee, Ill.

SAND (Core, Molding, Blasting)

American Silica Sand Co., Ottawa, Ill.
Carpenter Brothers, Inc., 606 West Wisconsin, Milwaukee 3, Wis.
Great Lakes Foundry Sand Co., United Artists Bldg., Detroit 26, Mich.

SAND (Core, Molding, Blasting) (Cont'd.)

Pangborn Corp., Hagerstown, Md.
Producers Core Sand Corp., Michigan City, Ind.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

SAND BLAST BARRELS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.

SAND BLAST CABINETS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SAND BLAST EQUIPMENT

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.

SAND BLAST NOZZLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Company, Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.

SAND BLAST ROOMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Hydro-Blast Corp., 2550 No. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.

SAND BLAST TABLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.

SAND BLAST CONDITIONERS

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.

SAND CONDITIONING (Chemical)

Johnson March Corp., 1724 Chestnut St., Philadelphia, Pa.

SAND CONTROL & TESTING EQUIPMENT

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND CONVEYING and HANDLING EQUIPMENT

American Air Filter Co., Louisville 8, Ky.
Ajax Flexible Coupling Co., Westfield, N. Y.
C. O. Bartlett & Snow Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.

SAND CONVEYING and HANDLING EQUIPMENT (Cont'd.)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Clearfield Machine Co., Clearfield, Pa.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Frank G. Hough Co., Libertyville, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Penn Iron Works, Reading, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

SAND CONVEYING and HANDLING EQUIPMENT (Pneumatic)

Fuller Company, Catasauqua, Pa.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.

SAND COOLING SYSTEMS

Newaygo Engineering Co., Newaygo, Mich.

SAND DRYERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.

SANDERS (Pneumatic)

Cleco Division of Reed Roller Bit Co., Houston, Texas.

SANDERS (Tapered-Spindles)

Wellman Products Co., 1444 E. 49th St., Cleveland 3, O.

SANDING MACHINERY (Disc, Spindle, Belt, etc.)

Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Oliver Machinery Company, Grand Rapids 2, Mich.

SAND MEASURING and WEIGHING DEVICES

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND MIXERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Blystone Division, Standard Sand & Machine Co., 549 W. Washington Blvd., Chicago 6, Ill.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Corp., Waterloo, Iowa.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.

SAND PREPARATION EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

SAND PREPARATION EQUIPMENT (Cont'd.)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Ajax Flexible Coupling Co., Westfield, N. Y.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Clearfield Machine Co., Clearfield, Pa.
Fordath Engineering Co. Ltd., West Bromwich, Birmingham, England.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Moulders Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Royer Foundry & Machine Co., Kingston, Pa.
Sather Mfg. Co., Everett, Wash.
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2—#2 Multi-Table TABLAST — PRICED TO SELL.

1—Pangborn ROTO-BLAST, Horizontal Spindles—NEW, NEVER INSTALLED.

1—Pangborn Hand Sandblast Cabinet, complete with Dust Collector—Excellent Condition.

MOLDING MACHINE

1—#333 Osborn Jolt Squeeze Roll-Over—Like New—CHEAP.

GRINDER

1—15 H.P. U. S. Swing Frame Grinder complete, 24" x 3" Wheel—Used Very Little.

Location: Our Cincinnati Warehouse
PHONE: Mr. Don Whitehead
PRINCETON 8405 (Glendale, Ohio)

L. J. LAND, INC.
146 GRAND STREET
NEW YORK 13, N. Y.
CANAL 6-6976

For Sale

FOR SALE

1—Tabor Handram Power Rollover Hydraulic Molding Machine 30" table ser. #24818
8—Tabor Power Rollover Molding Machines 22" table.
3—Osborn Rollover Hydraulic Box Draw Molding Machines New 20" x 40" x 12" x 8" draw. Model 147
2—405 Osborn jolt rollover and pattern draw Molding machines
3—#94 Osborn Core Blowers like new, with extra head
2—Tannewitz Metal Saws size G1E with 10 HP 220/440 V. motor like new.
1—Tabor cutoff saw with 10 H.P. Motor 220/440V.
1—#500 Fisher Motorized Nose Pour Crucible Furnace complete with blower, A-1 condition.
10—#1000 Fisher automatic tilting furnaces latest models.
8—#500 Monarch hand tilting furnaces
5—#1000 Monarch hand tilting furnaces
8—#500 Monarch dip furnaces
2—10 H.P. double arbor grinding stands, used for aluminum castings.
4—Overhead cranes—Norton Hi-lift

1—2 ton cap.	16'7"	span
1—2 ton cap.	22'	span
1—10 ton cap.	16'7"	span
1—10 ton cap.	18'	span

all floor operated.

675' Louden Monorail System with switches, cab operated, 3000 lb. cap. like new
65' Bucket elevator with 10 H.P. 220/440V. motor, buckets 12" x 8" x 7" like new
One 1 ton capacity "Lectromelt" furnace, complete with all controls. High voltage 13200 volts. All instruments in good condition.
Various sizes steel flasks.
Various sizes transite core plates
Various sizes Popoff flasks and jackets
Various sizes Snap flasks and steel bands.

EUCLID FOUNDRY & MACHINE EQUIPMENT CO.
15019 SARANAC RD. CLEVELAND 10, OHIO
TELEPHONE—GLENVILLE 1222 & 1538

FOR SALE
IN GOOD CONDITION

Cupola Blower. One General Electric centrifugal compressor. Type—F.S. 377, volume 10500, pressure 1.25, speed 3500.
General Electric Motor. Type FT 529 Y2 85 3600 Form E, volts 440, 3 phase, 60 cycle, No. 5226386.
With blast gate control panel, blast gate and motor starter.

BOX 699
THE FOUNDRY CLEVELAND 13, OHIO

FOR SALE

Several 42" dia. x 72" type "C" Sly tumbling mills. Direct and V-belt drives with or without motors.

NEW HAVEN FOUNDRY
NEW HAVEN, MICHIGAN

FOR SALE

3—Mercury platform lift trucks; 6000 lb. capacity complete with batteries and battery charger A-1 condition. An $18,000 value for $6500.00 for all.
3—Osborn #36 core draw machines @ $150.00 ea. A-1 shape. Worth $645.00 new.
1—Osborn #42 core rollover machine @ $150.00.

GRADY DRUECKER COMPANY
BOX 539 KOKOMO, INDIANA
PHONE 6260

FOR SALE

A reasonable offer will get you a modern sand handling system consisting of 19 individual moulders' hoppers, two 25-ton sand storage bins, one #50 Beardsley & Piper speed muller with 40 HP Motor, magnetic separator with bucket elevator, overhead monorail system and cab controlled electric hoist and monotractor and shell buckets with automatic trips for delivering sand from speed muller to moulders' hoppers.

OLD COLONY FOUNDRY COMPANY
EAST BRIDGEWATER MASSACHUSETTS

Classified Advertising

For Sale

FOR SALE
FOUNDRY EQUIPMENT

A large Massachusetts manufacturing concern has just discontinued its gray iron foundry operations to expand manufacturing facilities, thereby making all of its foundry materials, equipment and machines available for sale. The equipment and machines are all in good operating condition and consist of the type generally used in floor, bench and machine molding, such as:

CARL-MAYER BATTERY OF FOUR (4) CORE OVENS EACH AUTOMATICALLY OIL FIRED.
AMERICAN SAND CUTTER, NO. 766 MODEL D SIZE 96/78.
AMERICAN SAND CUTTER, NO. 238 MODEL M SIZE 99/80.
VIBRATING SCREEN, 6' x 4'.
LANCASTER COUNTER CURRENT RAPID BATCH MIXER — BUCKET LOADER — 15 HP. 550 VOLT 60 CYCLE 3 PHASE MOTOR.
AMERICAN WHEELABRATOR, 48" x 42" WITH DUST COLLECTOR AND BLOWER.
WILBRAHAM GREEN NO. 6A ROTARY PRESSURE BLOWER WITH 40 HP. 550 VOLT 60 CYCLE MOTOR.
TABOR MOLDING MACHINES OF VARIOUS TYPES, CHARGING CARS, STEEL FLASKS OF VARIOUS SIZES, ETC.

For full details of items you may be interested in or should you want to make a personal inspection at our plant—Write

BOX 767
THE FOUNDRY CLEVELAND 13, OHIO

WHY PAY MORE MR. FOUNDRYMAN?

Surplus Pneumatic tools are not worn out tools, they merely reverted to the claiming governmental agencies at the close of the war.

Try to beat these bargains:

Ingersoll-Rand #2 X M Air Drills	27.50 ea.
Chicago Pneumatic #2 Ring Value Chippers	17.50 ea.
Ingersoll-Rand #OOAJ ¼" Capacity Drills	12.50 ea.
Ingersoll-Rand #3 Grinders	45.00 ea.

Inquire on other Surplus Pneumatic tool bargains.

All merchandise sold postpaid and on money back or replacement basis.

R. D. SHERRILL & CO.
535 ELLIOTT AVE. WEST
SEATTLE 99, WASHINGTON

FOR SALE

1 only 1500 lb. melting capacity Greene electric arc furnace, 3 phase—where is, as is—complete up to the transformers. This furnace was built in August, 1930 and was modernized with the installation of modern controls in 1940. For further information, write or call: ELECTRIC STEEL FOUNDRY CO., PORTLAND, OREGON.

FOR SALE

Used Whiting belt-driven Foundry tumblers
1-48" dia. by 84" long inside
1-48" dia. by 72" long inside
3-30" dia. by 72" long inside
1-30" dia. by 48" long inside

VERMONT SALVAGE CORPORATION
ST. JOHNSBURY, VERMONT

CLEARFIELD MULLER

No. 404 Clearfield Sand Muller in good condition.

PIONEER FOUNDRY & MFG. CO.

GILBERTVILLE, MASS.

FOR SALE

Ideal for small foundry, all equipment necessary to manufacture Pierce Butler Little Giant cast iron radiators. Includes steel patterns (six different sizes) flasks, bottom plates, weights, core patterns, core driers, etc. Bargain for quick sale. Address: Box 801, The FOUNDRY, Cleveland 13, Ohio.

For Sale

FOR SALE

Two (2) Heroult electric arc furnaces, side door charge, roof removable, complete except that no furnace transformers are included. Electrical control equipment available for one furnace only. In good condition. 8' diameter shell. 7,500 pound capacity.

Two (2) Osborn stationary #332-38 jolt squeeze rollover power draw molding machines. In excellent shape.

Both items are offered for any reasonable price. Space needed.

LEBANON STEEL FOUNDRY
LEBANON, PA.

FOR SALE

Toledo one spot dial scale, dial 1000 lbs. x 1 lb., 400 and 200 lb. tare beams. New 1947.

Ingersoll Rand type FS355 direct connected blower, 4600 c.f.m. at 1 lb. pressure, blast gate, automatic controls. New 1946.

THE BAIRD MACHINE CO.

STRATFORD, CONN.

SOIL PIPE AND FITTING EQUIPMENT

Midwestern foundry has available for sale, shell patterns, arbors, pipe machines, special ladles and other equipment necessary for the manufacture of soil pipe and fittings. Address: Box 806, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

WE HAVE CLOSED OUR GRAY IRON FOUNDRY AND HAVE THE FOLLOWING EQUIPMENT FOR SALE:

4 Type R94 Pioneer Molding Machines.

8 Model 104-5 Milwaukee Molding Machines.

1 Connersville Heavy Duty Horizontal Blower Complete with Pulleys, Safety, Switches and Controls.

1 Fairbanks Morse, 30 h.p. Induction Motor, 60 Cycle, 220 Volt, 3 Phase.

1 Modern Equipment Company #4 Foundry Cupola.

1 Portable Sand Cutter, 6' Long and 3' in Diameter Complete with Motor, Controls and Safety Switches.

1 Hauck Manufacturing Company Gas Fired Ladle.

6 Modern Equipment Company, 150 lb. Ladles Complete.

3 Modern Equipment Company, 600 lb. Ladles Complete.

1 F & H, 1 Ton, Electric Lift with Cable and Motor.

1 20 h.p. Louis Allis 1740 R.P.M. Motor.

3 Louis Allis, 1 h.p. 1140 R.P.M. Motors.

1 Beardsley & Piper Company Model S Screenarator.

1 International Molding Machine, Model 3711—14X8R.

1 American Air Filter, 36" x 36" x 24" High Steel Dust Collector Complete.

1 Delco 7½ h.p. 1160 R.P.M. Motor.

1 Modern Equipment Cupola Charging Unit with 30" Capacity Steel Bucket Guildes, Cable, Motors, Controls, Complete.

Aluminum Alloy Flasks, Hardwood Flasks and Many Other Pieces of Foundry Equipment.
This equipment will be sold first come—first served. Make us an offer!

PICK MANUFACTURING COMPANY
WEST BEND WISCONSIN

For Sale

FOR SALE

TURBO BLOWERS (3 Phase, 60 Cycle)

cfm	Pressure	Make	Motor H.P.	Volts	Speed
3500	40 oz.	Spencer	60	440	1800
2200	40 oz.	Spencer	40	220/440	3600
1400	16 oz.	Spencer	220/440	3/60	3600
1050	32 oz.	Spencer	15	550	3500
900	24	Spencer	15	220/440	1800
225	10	Spencer	1	220/440	3600
PRESSURE BLOWERS (3 Phase, 60 Cycle)					
2500	7 oz.	Sturtevant	15	220/440	1800
2400	14 oz.	Mahr	15	220/440	3480
1300	16 oz.	Nth.Amer.	10	440	1800
1150	20 oz.	Nth.Amer.	10	220/440	3600
950	16 oz.	Nth.Amer.	7½	220/440	3600
660	20 oz.	A & B	7½	440	3600
550	20 oz.	A & B	5	440	3600
450	6 lbs.	A & B	30	220/440	3450
340	20 oz.	A & B	3	440	3600
250	12 oz.	Gen. Elec.	2	220/440	3600
150	12 oz.	Nth.Amer.	1	220	3600

MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVENUE
CLEVELAND, OHIO

FOR SALE

PRICED TO SELL

Pangborn 2SGK2 Rockerbarrel, complete with loader and $4,000.00 spare parts, Like new. $5,000.00

Pangborn 7GK2 Rockerbarrel with loader, used very little. $3,950.00

Wheelabrator Tum Blast 27 x 36, needs repair. $500.00

Wheelabrator Tablast #2, used 3 years, As is. $1100.00

Dust Collectors, Sand Blast Hand Cabinets, All sizes, Like New, 40% of list price.

If you are interested in savings of 25% to 70% on your Sand Blast replacement parts (Wheelabrator, Pangborn, etc.) write immediately stating type, size of your Sand Blast Machines (Tum Blast, Tablast, etc.) and we will mail listing of parts available for your equipment.

DIAMOND-SAND BLAST CO.
5654-W. JEFFERSON
DETROIT 9, MICHIGAN

MOLDING MACHINES FOR SALE

2 Tabor Shockless Jar 30" Rollover and Pattern Draw—30" x 40" Rollover Plate, 12" Draw, 1000 pound capacity — air clamps — $900.00 each. Guaranteed in A-1 condition. Late Models.

2 Herman Jar Rollover 24" x 30", 1000 pound. Pattern Draw Machines $450.00 each.

1 Herman Jar Rollover 40" x 56", 3000 pound. Pattern Draw Machine $650.00.

F.O.B. OUR PLANT
STANDARD PATTERN WORKS—
MACHINE DIVISION
6771 EAST McNICHOLS ROAD
DETROIT 12, MICHIGAN

FOUNDRY EQUIPMENT FOR SALE

27x36 Tumblast Wheelabrator
New Price $4550.00
Our Price 2775.00

15x20 Tumblast Wheelabrator
New Price $2000.00
Our Price 1200.00

Type BM 75887 Sand Blast, Size 2C
New Price $ 500.00
Our Price 300.00

Model AM Sandcutter
New Price $4975.00
Our Price 2985.00

All equipment in A1 condition. Pictures available upon request.

SERVICE FOUNDRY, INC.
330 N. ROCK ISLAND
WICHITA, KANSAS

FOR SALE

2—Osborne #601 Molding Machines
1—Osborne #275-J Jolt Squeezer
1—Spencer Turbo Compressor, 1300 Cu. Ft. Per Min. @ 32 oz, 25 HP, 3 PH, 60 CY, 220-440 V, 1750 RPM, Westinghouse Motor
1—36 x 42 American Wheelabrator Tumblast
1—Sly Centriblast Table, 6 Ft. diameter. Used 30 months.

BOX 765
THE FOUNDRY CLEVELAND 13, OHIO

Classified Advertising

For Sale

FURNACES & OVENS

1—Furnace, melting, rotary hearth, gas, "Continental", approx. 18' dia.
1—Furnace, pre-heating rotary hearth, elec., "G.E.", 175 KW, 18' dia. Cat. No. 5364787 GR-1, with transformers, motors and gas converter.
1—Oven type furnace, "American Gas Furnace Co." #1, 7" x 12" x 29".
27—"Fisher" melting furnaces, size B for #25 crucibles.
7—"Hoskins" electric furnaces, model FR 252.9 box type, 2000 deg. F 26 KW, with 2 transformers
6—"Monarch", Simplex melting furnaces, 500# cap., model #92, oil fired, hand rocking, 1 burner on each end of furnace, rammed with plastic brick and lined with 1" of SO 38 refractory.
1—"Monarch" Simplex furnace, 1000 lb. cap., with blower and mtr.
1—"Ind.-Heating" Circ-Air gas fired, 20 W x 7" ht. x 9' long heating chamber, including motor, blower and controls; conveyor type used for drying, No. 6270-1000°.
1—"Ind. Heating" oven type heat treat comp. with motors and controls No. 8498-2100°. Inside dim. 6 ft long, 18 in. wide, 12 in. high with air cyl. operated door.
1—"Industrial Heating" melting furnaces, pot size 24" L x 19" W x 11" deep with burners, manifold and mixer.

BLOWERS

Crane "American Monorail", 500 lb. cap. with Hyatt model A trolley.
Blower, "Buffalo Forge" size 3½ duplex conoidal with 2 HP motor.
Blower, "American Sirocco" #5 type V syphon with 5 hp motor.
Exhaust system including blower, "American" #5 and 5 HP motor.
"Schmeig" dust collecting system including water tank dust collector, "American" blower No. 35, and one 5 HP motor and one 7½ HP motor.
Blower, "American Sirocco" #5 type V syphon with 5 hp motor.
Blower, "Spencer Turbo" 1000 CFM, 24 oz. with 10 HP motor, 3500 RPM, 440 volt, 3 phase, 60 cycle.
Exhaust system with American blower, type P size 5.
Blower, "American" #6 for foundry ventilation.
Blower, "American Sirocco" #3—5000 CFM with 2 hp motor—man cooler.
Exhaust system for "Fisher" furnaces including hoods (2) stocks, (17) air cylinders and (2) #4 blowers with 3 HP motors.
Blower, "Spencer Turbo" 150 CFM, 24 oz. with motor.

BOHN ALUMINUM & BRASS CORP.
1400 LAFAYETTE BLVD., DETROIT 26, MICH.

FOR SALE

1—Whiting Cupola #6-50 foot stack. Dismantled and in excellent condition.
1—Spencer Turbo Blower with 40 H.P. Motor.
1—Root Blower #7 with 75 H.P. Motor.
1—Lindberg Pit Type Tempering Furnace—Type 2828-EH Serial #1337.
1—American Wheelabrator Multi Tablast Model BM-66200, Serial #A50689.
1—Simpson Mullor Model O.
2—Tannewitz Bandsaws with 36" wheels and one with 42" wheel—excellent condition.
7—Double End Pedestal Grinders.
1—Royer Shakeout Machine.
12—Tabor Stationary Jar Top Squeezers.
4—Osborn Squeezers Model 276-J.
2—Tabor Portable Jar Flask Lift Moulding Machines—20" x 24" table.
1—Tabor Portable Shockless Jar Flask Lift Moulding Machine—32" x 32" table.

OLD COLONY FOUNDRY COMPANY
EAST BRIDGEWATER MASSACHUSETTS

FOR SALE

Slightly used Beardsley & Piper junior motive sand slinger in excellent condition. New in 1946.

FRANK W. SMITH, INC.
450 CHESTNUT ST. GARDNER, MASS.

For Sale

FOR SALE

The equipment listed is almost new and priced to sell!
1—Osborn Type 405-77 Jolt Rollover and Pattern Draw—size—64" x 50"—with runout car.
6—Osborn Type 2047—Jolt Rollover and Pattern Draw—size—24" x 24"
1—Newago Core Crusher—12" x 36"—10 Ton per Hour.
2—International Clamp and Draw—76" x 9½" Draw.
1—Kane and Roach Core Wire Straightener—No. 5 DX—⅜" capacity.
All equipment can be inspected at our warehouse and immediately available.

GLOBE TRADING COMPANY
1817 FRANKLIN STREET DETROIT 7, MICH.
PHONE: WOODWARD 1-8277

GRAY IRON FOUNDRY EQUIPMENT FOR SALE

Capable of handling thirty-five molders
Jolt Squeezers
No. 5 Whiting cupola complete with skip hoist and all controls
Two (2) 500 pound Bowl Ladles
Nine (9) Tumbling Mills
Four (4) Grinders and Shaft complete
Several Large Motors
One (1) American Sand Cutter, model AN 7450 complete with motor, cable, and five wall sockets
NEW One (1) CP Compressor
One (1) Gardner Denver Compressor used two years

DeKALB FOUNDRY CORP.
DeKALB, ILL.

FOR SALE

SAND BLAST, Sly C-9109, 10 ft. x 12 ft. room. Outside loading turntable with steel housing dust collector #45-360, fanhouse air ducts, etc. 15 H.P. motor and fan.

GENERAL WRECKING CO.
3304 CHOUTEAU AVE.
ST. LOUIS 3, MO.

EQUIPMENT FOR SALE

PANGBORN SHOT BLAST ROOM

New—never installed. Size 12' x 25' with two blast chambers, complete with new Pangborn Dust Collector, 60 cycle A. C. motors.

BEARDSLEY & PIPER SANDSLINGER

Motive Jr. track traveling type; had very limited use—excellent conditions.

BEARDSLEY & PIPER SAND CONDITIONER

In fine condition—used about one year. Magnetic pulley.

SIMPSON NO. 1 SAND MULLERS

2 machines available—one is practically new.

SULLIVAN W. G. 9—75 H.P.
—AIR COMPRESSOR

SULLIVAN NO. 16—125 H.P.
—AIR COMPRESSOR

Both in very fine condition, with complete electrical equipment; 220 Volt, 60 cycle A. C. Other equipment:—No. 7 Whiting Cupola with new Foxboro Air Weight Control; Complete Laboratory; American Sand Cutter; American Dustube Collector; Mold Wash Mixer; Hendey Mobile Yard Crane with Lifting Magnet. For information, address:

MR. M. R. GAULT
HANNIFIN CORPORATION
1101 S. KILBOURN AVE. CHICAGO 24, ILL.,
TELEPHONE NEvada 8-0406

For Sale

EQUIPMENT FOR SALE

MOLDING MACHINES

1—74J-W Osborn Jolt Squeeze Portable.
2—75J-W Osborn Jolt Squeeze Portable.
3—75J Osborn Jolt Squeeze Portable.
3—Federal RAPID Jolt Squeeze Portable.
2—SPO #611B Stationary, Oscillating, Jolt Squeeze Strippers.
1—SPO #4½ JHS Air Jolt Hand Strip.

BLOWERS FOR CUPOLAS AND FURNACES

1—Piqua rotary pressure blower, rated 19 cu. ft. per revolution.
Maxon-Premix Blowers for Gas, ¼ to 1 H.P.

METAL MELTING EQUIPMENT

1—Hausfeld 2000# aluminum capacity furnaces, barrel type, open flame, oil fired.
2—Monarch-Rockwell Rotating, 500# brass, oil.
1—Buckeye #150 Crucible tilting furnace, with Premix blower for gas fire.
New 32" to 41" Dia. shell Cupolas made to order.

TUMBLING MILLS AND SAND BLAST

3—36" dia. x 54" long reliable tumbling mills.
1—Pangborn No. 2 GH direct pressure type sandblast barrel, motor driven. Complete unit.
1—Pangborn LE 4 ft. sandblast table, continuous sand feed, motor driven. Complete unit.
1—Pangborn Sand Blast Unit including generating tank, shot cleaner, bucket elevator. Suitable for use with room.
1—Pangborn type EN-2 sand blast cabinet, suction type, 5 x 3 x 7 high.

MISCELLANEOUS

5—Kock electrically heated ovens for baking cores, 4½ ft. wide, 6 ft. high, 6 ft. deep, complete with recirculating fan and controls.
1—Young Bros. tower core oven, 5 ft. x 1 ft. shelves, gas fired, complete with Foxboro control.
1—Young Bros. batch type recirculating hot air, gas fired, core oven, 5 ft. x 6 ft. door opening, 9 ft. deep.
3—Foundry Equipment Co. sliding shelf core ovens, with five 30 x 42" shelves, 8" high, gas fired.
1—Lampson Endless Mold Conveyor, 100 ft. long x 16 ft. wide, with 19 x 26" pallets, 36" on centers.
6—24" wide belt conveyors for sand, totalling approximately 500 ft. Individual units can be furnished any desired length.
17—Sand hoppers with foundry type bin gate.
1—Bucket sand elevator, 50 ft. tall, complete.
4—Heavy duty flexible shaft grinders 2 HP.

CLIFTON MACHINERY CO.
1023 W. 6th ST. CINCINNATI 3, OHIO
PHONE PARKWAY 7812

FOR SALE

1—6 K.W. Ajax Electrothermic high frequency induction unit. Ideal for laboratory work. $800.00

NATIONAL PRECISION CASTING CORP.
CLIFTON HEIGHTS, PA.

FOR SALE
NUMBER 3 SIMPSON #2200 MIXER

Including reducer, #3 Aerator, #3 loader skip hoist, 20" wide belt conveyor, one box car loader, one 40 HP motor and starter, one #5 H.P. motor for loader, one #5 H.P. motor starter for Aerator, one #3 H.P. motor and starter for conveyor. Details furnished on inquiry to

PORTER WARNER INDUSTRIES, INC.
334-9 VOLUNTEER STATE LIFE BLDG.
CHATTANOOGA, TENNESSEE

FOR SALE
ELECTRIC MELTING FURNACE

TOP CHARGE 9 FT. DIAM. SHELL, WITH 2500 KVA TRANSFORMER. VERY LITTLE USED, IN GOOD CONDITION.

FRANK B. FOSTER, INC.
1217 OLIVER BLDG. PITTSBURGH 22, PA.

Longer Nozzle Life *Every* Time

IF YOU are looking for a way to increase nozzle life in your blast cleaning department—if you wish to do away with costly time-wasting while worn-out nozzles are replaced with new nozzles—if you are searching for means to improve blasting efficiency and increase production—there is one answer for all three problems: NORBIDE Nozzles. Made of Norton Boron Carbide—the hardest man-made material—NORBIDE Nozzles will outwear conventional types fifty to one. This same wear-resistance enables these nozzles to retain peak efficiency for a long period with resultant production increases. Air consumption is reduced 10 to 20%. Stream contour and abrasive velocity are maintained.

For information as to size and price write for Bulletin No. 543

NORTON COMPANY

Worcester 6, Massachusetts

NORTON NORBIDE PRODUCTS

ADVERTISING INDEX

A

Accurate Match Plate Co. ... 151
Acheson Colloids Corp. ... 147
Acme Foundry Co. ... 245
Adams Co., The ... 60
Air Reduction ... 181
Air-Way Pump & Equipment Co. ... 255
Ajax Electric Co., Inc. ... 210, 211
Ajax Electric Furnace Corp. ... 210, 211
Ajax Electrothermic Corp. ... 210, 211
Ajax Engineering Corp. ... 210, 211
Ajax Metal Co. ... 210, 211
Allis-Chalmers Mfg. Co. ... 55
Alloy Metal Abrasive Co. ... 251
American Air Filter Co., Inc. ... 65
American Bridge Co. ... 245
American British Chemical Supplies, Inc. ... 250
American Colloid Co. ... 171
American Foundrymen's Society ... 163
American Cyanamid Co. ... 56
American Lacquer Solvents Co. ... 252
American Lava Corp. ... 244
American Optical Co. ... 37
American Smelting & Refining Co. ... 242
American Steel Abrasives Co., The ... 255
American Tank & Fabricating Co., The ... 46
American Wheelabrator & Equipment Corp. ... Front Cover, 33, 34, 35, 36
Angell Nail & Chaplet Co., The ... 257
Apex Smelting Co. ... 19

B

Babcock & Wilcox Co., (The Refractories Div.) ... 113
Baroid Sales Div., National Lead Co. ... 229
Bartlett, C. O., & Snow Co., The ... 161
Beardsley & Piper Div., of Pettibone Mulliken Corp. ... 166, 167, 168, 169
Black, Sivalls & Bryson, Inc. ... 183
Blaw-Knox Div., of Blaw-Knox Co. ... 250
Bloomsbury Graphite Co. ... 253
Bradley Washfountain Co. ... 214
Buffalo Forge Co. ... 109
Buffalo Pattern Works ... 116

C

Campbell-Hausfeld Co., The ... 217
Carborundum Co., The ... 48, 111
Central Pattern Co. ... 235
Centrifugal Casting Machine Co. ... 246
Champion Foundry & Machine Co. ... 8, 9
Chicago Mfg. & Distributing Co. ... 248
Chisholm-Moore Hoist Corp. ... 225
Cities Service Oil Co. ... 175
Clark Equipment Co. ... 198
Clearfield Machine Co. ... 50
Cleco Div., of the Reed Roller Bit Co. ... 26
Cleveland Chaplet & Mfg. Co. ... 255
Cleveland Flux Co., The ... 187
Cleveland Metal Abrasive Co., The ... 200, 201
Cleveland Quarries Co., The ... 209
Cleveland Tramrail Div., The Cleveland Crane & Engineering Co. ... 140
Climax Molybdenum Co. ... 228
Columbus-McKinnon Chain Corp. ... 225
Corn Products Refining Co. ... 177
Crobaugh, Frank L., Co., The ... 250
Curtis Pneumatic Machinery Div., of Curtis Mfg. Co. ... 27

D

Davenport Machine & Foundry Co. ... 29
Dayton Pneumatic Tool Co. ... 248
DeBardeleben Coal Corp. ... 256
Delta Oil Products Co. ... 10
Demmler, Wm. & Bros. ... 54, 244
Despatch Oven Co. ... 51
Detroit Electric Furnace Div., Kuhlman Electric Co. ... 123
Detroit Testing Machine Co. ... 233
Dougherty Lumber Co. ... 234

E

Eastern Clay Products, Inc. ... 39
Eastman Kodak Co., X-ray Div. ... 139
Electric Furnace Co., The ... 256
Electro Metallurgical Div., Union Carbide & Carbon Corp. ... 45
Electro Refractories & Alloys Corp. ... 256
Empire Varnish Co., The (Waterlox Div.) ... 242

F

Fanner Mfg. Co., The ... 22
Federal Foundry Supply Co., The ... 2, 194
Federated Metals Div., American Smelting & Refining Co. ... 28
Fisher Furnace Div., Lindberg Engineering Co. ... 11
Foundry Equipment Co., The ... 14
Foundry Supplies Mfg. Co. ... 42
Foxboro Co., The ... 32
Fox Grinders, Inc. ... 208
Fremont Flask Co., The ... 203

G

Gardner-Denver Co. ... 20
General Electric Co. ... 25
General Electric Co., Chemical Department ... 247
General Electric X-ray Corp. ... 157
Globe Steel Abrasive Co., The ... 62
Great Western Mfg. Co. ... 205

H

Harbison-Walker Refractories Co. ... 64
Hauck Mfg. Co. ... 252
Herman Pneumatic Machine Co. ... 31
Hickman-Williams & Co., Inc. ... 199
Hines Flask Co., The ... 66, 67
Hough, Frank G., Co., The ... 43
Hydro-Blast Corp. ... 58, 59

I

Imperial Belting Co. ... 233
Industrial Equipment Co. ... 237
Ingersoll-Rand Co. ... 126
International Graphite & Electrode Corp. ... 52
International Molding Machine Co. ... 152, 153
International Nickel Co., Inc., The ... 1

J

Jackson Iron & Steel Co., The ... 256
Jeffrey Mfg. Co., The ... 13
Johns-Manville ... 202

K

Kirk & Blum Mfg. Co., The ... 63
Krause, Chas. A., Milling Co. ... 115

Continued on page 278

ADVERTISING INDEX

L

Lanly Co., The ... 218
Lindberg Engineering Co. ... 11
Link-Belt Co. ... Back Cover

M

Manhattan Rubber Div. ... 249
Master Pneumatic Tool Co., Inc., The ... 252
Mathews Conveyer Co. ... 173
Mathieson Chemical Corp. ... Inside Front Cover
Metal Blast, Inc. ... 119
Metallizing Co. of America ... 222
Metalloy Corp. ... 224
Miller, Herbert F. ... 256
Milwaukee Foundry Equipment Co. ... 44
Modern Equipment Co. ... 280
Moline Iron Works ... 252
Moulders' Friend, The ... 40
Murphy, Jas. A., & Co. ... 248, 257

N

National Carbon Co., Inc. ... 131
National Engineering Co. ... 155
Neff & Fry Co., The ... 251
Newaygo Engineering Co. ... 197
Niagara Falls Smelting & Refining Div., Continental Copper & Steel Industries, Inc. ... 204
Northwestern Iron & Metal Co. ... 251
Norton Co. ... 18, 179, 276

O

Oliver Machinery Co. ... 250
Osborn Mfg. Co., The ... 142, 143
Ottawa Silica Co. ... 133

P

Pacific Graphite Co., Inc. ... 250
Pangborn Corp. ... 6, 7, 165, 227
Parsons Engineering Corp. ... 256
Penn Iron Works ... 240
Pittsburgh Crushed Steel Co. ... 219
Pittsburgh Lectromelt Furnace Corp. ... 185
Pittsburgh Metals Purifying Co. ... 120
Plaster Process Castings Co. ... 246
Pressed Steel Co., The ... 21
Producers Core Sand Corp. ... 256
Puro-Seal Co., The ... 254
Putnam, A. H., Co. ... 254
Pyrometer Instrument Co., The ... 249

R

Radium Chemical Co., Inc. ... 247
Raybestos-Manhattan, Inc., Manhattan Rubber Div. ... 249
Redford Iron & Equipment Co. ... 136
Republic Coal & Coke Co. ... 253
Republic Steel Corp. ... 145
Rietz Lumber Co. ... 232
Roots-Connersville Blower Corp. ... 162
Rotor Tool Co., The ... 15
Roura Iron Works, Inc. ... 242
Royer Foundry & Machine Co. ... 103
Royersford Foundry & Machine Co. ... 254

S

Schneible, Claude B., Co. ... 24
Schramm, Inc. ... 223
Scientific Cast Products Corp., The ... 236
Shanafelt Co., The ... 41
Simonds Abrasive Co. ... 38
Simplicity Engineering Co. ... 193
Sly, W. W., Mfg. Co., The ... 105
Smillie, C. M., & Co. ... 257
Smith Oil & Refining Co. ... 191
Smith & Richardson Mfg. Co. ... 240
Smith, Werner G., Co., The ... 4, 5
Smooth-On Mfg. Co. ... 244
Solvay Sales Div., Allied Chemical & Dye Corp. ... 189
SPO, Inc. ... 134
Standard Conveyor Co. ... 221
Standard Horse Nail Corp. ... 235
Standard Silica Corp. ... 254
Steel Shot & Grit Co. ... 219
Sterling Wheelbarrow Co. ... 68, 231
Stevens, Frederic B., Inc. ... Inside Back Cover
Stone-Wallwork Ltd. ... 53
Stroman Furnace & Engineering Co. ... 57
Surface Combustion Corp. ... 249
Swartwout Co., The ... 246

T

Tabor Mfg. Co., The ... 47
Tamms Industries, Inc. ... 231
Taylor, Chas., Son Co., The ... 12
Taylor, S. G., Chain Co. ... 254
Timken Roller Bearing Co., The ... 61
Truscon Steel Co. ... 23

U

Union Carbide & Carbon Corp. ... 45, 131
United States Graphite Co., The ... 129
United States Gypsum Co. ... 30
United States Rubber Co. ... 164
United States Steel Corp. ... 245
United States Steel Corp., Subsidiaries ... 245
United States Steel Export Co. ... 245
Universal Engineering Co. ... 49

V

Vanadium Corp. of America ... 149
Velsicol Corp. ... 279
Vonnegut Moulder Corp. ... 240

W

Wedron Silica Co. ... 237
Wellman Bronze & Aluminum Co., The ... 230
Wellman Engineering Co., The ... 254
Western Metal Co. ... 192
Wheland Co., The ... 253
Whiting Corp. ... 16, 17
Will, Arthur E. ... 220
Woodward Iron Co. ... 107

Table of Contents Page 3

Classified Advertisers, Pages 271, 272, 273, 274, 275

Service Contributes to Performance!

Foundrymen have found that *Velsicol* core *oils* possess the essential properties of clean workability, high bonding strength to low gas evolution, fast baking and controlled uniformity.

In addition to manufacturing an outstanding core oil, *Velsicol technical service* stands ready to assist in solving your specific casting problems. Data based on practical experience and research gladly furnished upon request. Your own tests will convince you that *Velsicol core oils* can improve your casting production.

VELSICOL CORPORATION

330 EAST GRAND AVENUE, CHICAGO 11, ILLINOIS • Representatives in Principal Cities

General view of one section of the Gilson foundry at pouring off. This section represents about 2/3 of daily 60 Ton output. Balance of foundry is similarly mechanized.

60 Tons Per Day The MODERN Way

EQUIPMENT COMPANY

at J. E. Gilson Co. Foundry

Light snap-flask molds being poured with a 13" *MODERN* Tapered Covered Ladle of about 200 lbs. capacity mounted on a MODEL F Pouring Device.

...thru Efficient Mechanized Distribution and Pouring of Molten Metal

The pictures on this page were taken in a foundry mechanized for high production pouring by the installation of properly engineered MODERN EQUIPMENT. Superstructures, runways, cranes, hangers, pouring devices, pouring ladles and distributing ladles . . . all bear the MODERN Trade Mark.

The MODERN EQUIPMENT CO. offers foundrymen the benefit of its long and varied experience in the engineering and production of equipment for complete mechanization of metal pouring and distributing operations.

Ask Your MODERN Representative or Write for Illustrated Bulletins

Partial view of squeezer floor operation shown in top picture. Molders pour their own molds with *MODERN* Ladles and Pouring Devices suspended from *MODERN* Cranes and Runways. The result is higher mold production.

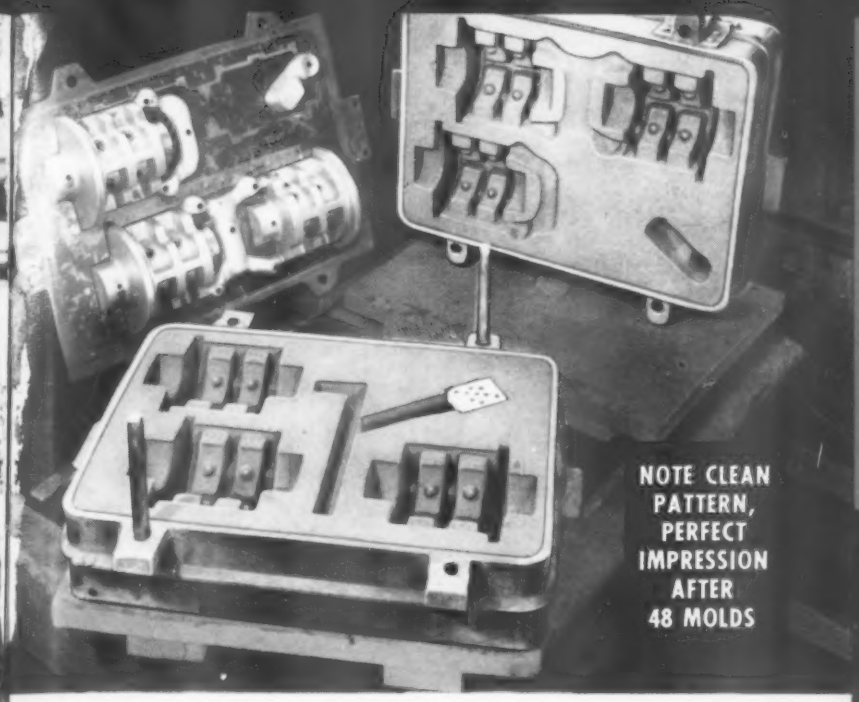
MODERN EQUIPMENT CO.

FORT WASHINGTON, WISCONSIN

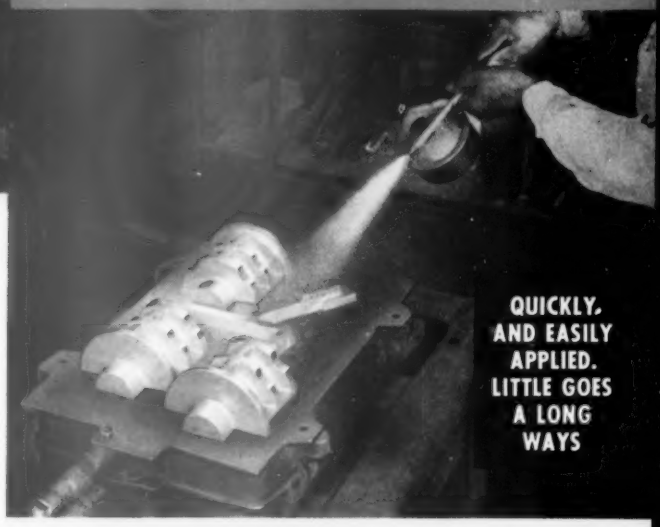
CUPOLAS • CUPOLA CHARGERS • LADLES OF ALL TYPES • POURING DEVICES • METAL POURING SYSTEMS • CRANE AND MONORAIL SYSTEMS • ELECTRIC CRANES.

Stevens "Liquid" Parting

One Parting With No Regrets for Any User



NOTE CLEAN PATTERN, PERFECT IMPRESSION AFTER 48 MOLDS



QUICKLY, AND EASILY APPLIED. LITTLE GOES A LONG WAYS

THE phenomenal success of Stevens Liquid Parting used by production and jobbing foundries everywhere, doing all classes of work, is ample proof of its great value to the foundry industry.

Stevens Liquid Parting is a thin, transparent, light green liquid with a pleasant aroma. It is non-toxic, either by contact with the skin or by inhalation. When sprayed, brushed or swabbed on patterns and match plates Stevens Liquid Parting forms a very thin surface film that insures rapid, clean parting and smooth casting finish. The coating does not "build-up"—is so thin that castings can be held to closest tolerances.

As an all-purpose product easy, efficient and economical to use, you'll find Stevens Liquid Parting can't be equalled as a time and money saver in your foundry.

Order one, or five gallons, or even a drum of Liquid Parting today *at our risk*. If you're not more than pleased with the results obtained, just return the unused portion for full credit or we'll cheerfully refund your money. You be the judge. You can't lose—you stand to gain plenty by way of faster, better, more productive molding. *Send in your order now.*

GET THESE BENEFITS WITH STEVENS LIQUID PARTING

- **ECONOMICAL**—25 to 50 molds can be made from one application to match plate and pattern.
- **SAVES TIME** as against applying dry parting to pattern for each mold.
- **IDEAL** as core box parting.
- **INSURES PERFECT PATTERN LIFT** from sand, even for difficult draws.
- **NON-TOXIC**—NO DUST for molders to breathe.
- **EXCELLENT CLEANER** for surfaces of dirty, gummed-up patterns, match plates and core boxes.
- **PREVENTS RUST** when used before storage of metal patterns, match plates and core boxes.

OTHER IMPORTANT USES

STOPS SAND STICKING and bridging when used as a lubricant coating inside sand hoppers, sand conditioning equipment and on molder's shovels.

Successfully used to coat all metal surfaces to prevent sticking of any material containing water; for example: on plates and rings for molding grinding wheels. On molds for forming foam or sponge rubber and on molds for forming ceramic shapes prior to firing.

SINCE 1882 STEVENS INCORPORATED EVERYTHING FOR A FOUNDRY DETROIT 16 MICHIGAN

LEADING MANUFACTURERS AND DISTRIBUTORS OF FOUNDRY FACINGS, EQUIPMENT AND SUPPLIES

FREDERIC B. Stevens INCORPORATED

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Representatives in Principal Cities

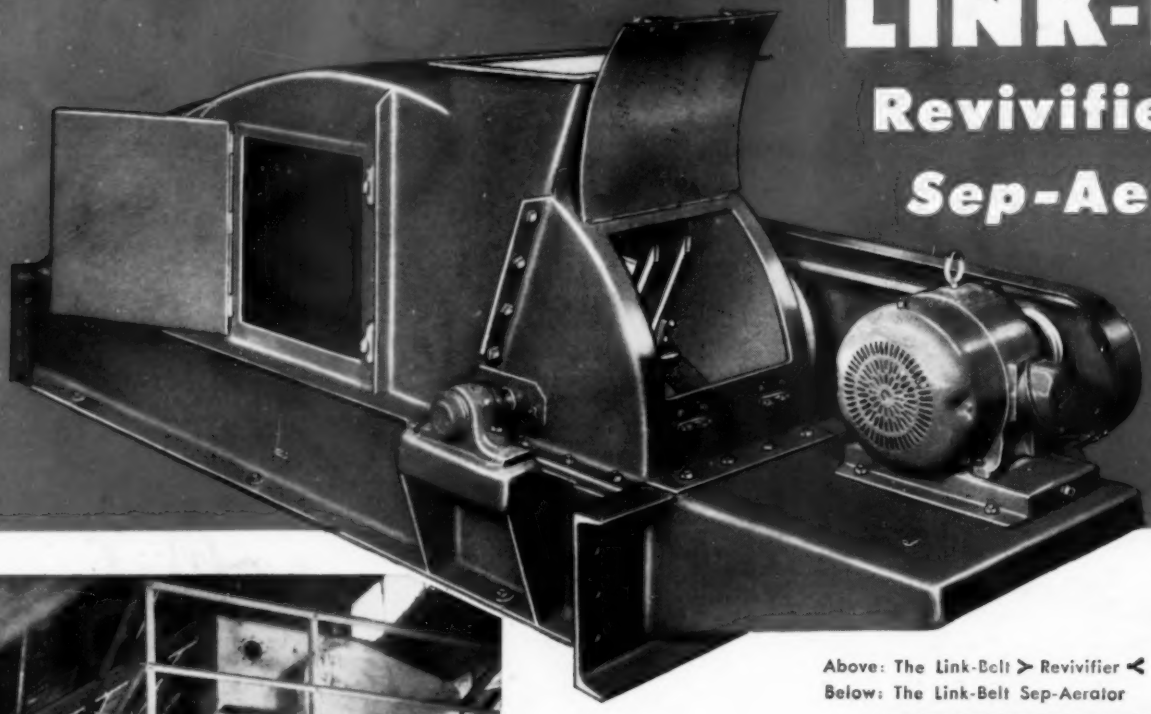
FREDERIC B. STEVENS OF CANADA, LTD. WINDSOR, TORONTO, ONTARIO

FOUNDRY EQUIPMENT AND SUPPLIES DIVISION

Sand Preparation Cost Cutters

LINK-BELT

Revivifiers and Sep-Aerators

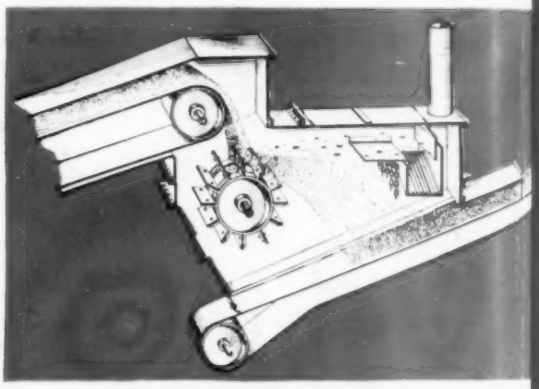


Above: The Link-Belt ≻ Revivifier ≺
Below: The Link-Belt Sep-Aerator

Link-Belt sand ≻ Revivifier ≺ installation in large foundry.

Link-Belt Sep-Aerator in foundry.

Produce uniform Fluffy sand with the Right "Feel"



THE MODERN, streamlined Link-Belt ≻ Revivifier ≺ effectively fluffs and cools foundry molding sand—producing a uniform, aerated and flowable sand with the right "feel"—sand that will ram to uniform density in the mold. Made in five sizes for maximum capacities of from 20 to 100 tons an hour.

A supplementary unit, the Link-Belt Sep-Aerator, is particularly adapted to non-ferrous foundries where it is not possible to remove metallic shot by magnetic means. It not only does a thorough aerating and mixing job, but also separates metallic shot, pebbles and small refuse. A high capacity unit, ideally suited for continuous systems.

Let us give you detailed information on these units.

11.72

LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

THE SYMBOL OF QUALITY L-B LINK-BELT

LINK-BELT CONVEYORS

AND PREPARATION MACHINERY

MANUFACTURER'S ASSOCIATION INC. FOUNDRY EQUIPMENT